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CHEST RADIOAUTOGRAPHY

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CHEST radioautography is a term used here for the first time to mean the recording of radioactivity present in the lungs and pulmonary structures by placing the patient's chest in contact with an ordinary exposure holder containing conventional roentgen film. Chest autoradiography and chest autography would be satisfactory synonyms depending upon how one is accustomed to verbalize the term *auto-histo-radiographie*, first used by Lacassagne[1] in 1924 in describing a method for the detection of radioactivity in histologic preparations from organs containing polonium.

A careful search of the radiologic literature reveals no previous mention of the very simple technical procedure to be reported here. Müller[2] described the autographic detection on roentgen film of a radioelement (Zn^{63}) in a macroscopic structure (female breast).

It is not the purpose of this report to discuss the nuclear medicine involved in the treatment of cancer of the thyroid gland with radioactive iodine nor to record the interesting laboratory data obtained in the course of treating such a malignant tumor by artificial radioisotope therapy. The facts pertinent to the reporting of a useful and convenient radiologic procedure termed chest radioautography are as follows:

CLINICAL DATA

The patient is a white female, aged thirty-seven, married and the mother of a healthy two year old son. She was referred for roentgen therapy with a diagnosis of papillary adenocarcinoma of the thyroid. The patient had been hospitalized for varying periods of time between August, 1930, and May, 1939, in a tuberculosis sanatorium and was discharged from the sanatorium in 1939 with healed pulmonary lesions, fibrocalcareous in appearance, distributed extensively throughout both lungs. During her pregnancy in 1950, roentgen and sputum examinations indicated that her pulmonary disease remained arrested and inactive. Symptoms referable to the thyroid gland began some ten years ago (1941–1942) when she first noticed a nodule in the right side of her neck which initially was associated with inability to speak for a duration of about four months. After that the nodule grew slowly without symptoms until during the pregnancy in 1950 when it increased markedly in size causing progressive dysphagia, especially on at-

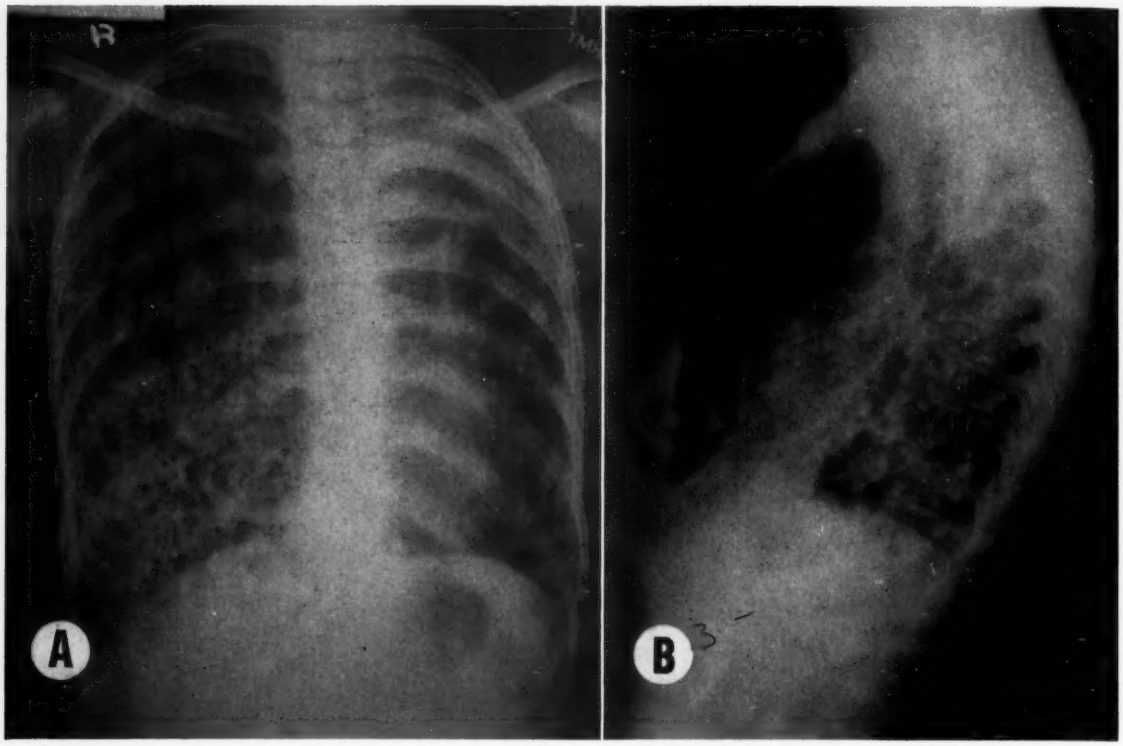

FIG. 1. (*A*) Posteroanterior roentgenogram made at time patient was referred for roentgen therapy. Old tuberculous changes in left lung and fibrocalcareous lesions throughout right lung are noted. Lesions throughout right lung did not resemble carcinomatous metastases from thyroid. (*B*) Right lateral roentgenogram made at same time. Examination of film with magnifying glass suggested lesions were fibrocalcareous.

tempting to swallow particles of meat. There have been no recent voice changes, tremors, palpitations or changes in her eyes. After the birth of the baby the mass in the right side of the neck was approximately the same size it had been during the period prior to pregnancy but was much softer in consistency and produced no dysphagia or voice difficulties.

On June 18, 1951, she was admitted to an Army Station Hospital where right vocal cord paralysis was discovered. The mass in the neck measured 5 by 7 cm. The basal metabolic rate was minus 4 per cent. The serum cholesterol was normal. A hemithyroidectomy was performed at the Station Hospital and a tumor mass was found densely adherent to the trachea and some of the great vessels. Consequently only a portion of the tumor was removed. The postoperative course was uneventful and the patient was transferred for roentgen therapy to the thyroid gland. Physical examination at this time revealed the operative scar, an approximately 5 by 7 cm. mass in the region of the left lobe of the thyroid and at least three adjoining palpable lymph nodes measuring about 2 cm. each. Posteroanterior and right lateral chest films demonstrated extensive fibrocalcareous lesions scattered throughout both lungs and old atelectasis and fibrous changes in the left apex with pulling of the trachea toward the left apex. The heart and great vessels appeared pulled to the left and upward as well (Fig. 1, *A* and *B*). These films compared with those taken in 1950 showed no essential change in the appearance of either lung. The question as to whether any of the densities in the right lung could represent metastatic lesions from the thyroid could not be answered with any degree of certainty. Even with a magnifying glass, the densities still more nearly resembled tuberculous calcifications. Comparison with the chest films obtained from the tuberculosis sanatorium showed the parenchymal lesions on our films (Fig. 1, *A* and *B*) to be practically identical in number and distribution to those seen on sanatorium films dated May 16, 1939. The appearance of these lesions had not changed appreciably since May, 1939. This observation further supported the idea

that these were healed fibrocalcareous lesions of tuberculous origin.

Between July 26, 1951, and August 11, 1951, the patient received 500 r (in air) to each of three fields over the thyroid area. A right and left lateral and a midline field each measured 6 by 8 cm. The factors used were 200 kv. (peak) (constant potential), 15 ma., half-value layer 1.4 mm. Cu, filter was 1 mm. Cu plus 1 mm. Al. The daily dose was 100 r to each field. At a special meeting of the Tumor Board of this hospital on August 12, 1951, it was decided that the patient should have tracer studies with I^{131} and if possible therapeutic dosage of I^{131}. Accordingly, arrangements were made for this* and external irradiation of the thyroid area was stopped.

On August 13, 1951, tracer studies with I^{131} revealed a 29 per cent uptake by the thyroid in twenty-four hours—well within the range of normal for euthyroid individuals[3]—and implied the presence of a significant amount of thyroid tissue in the neck. Scanning of the body surface disclosed that this uptake was almost entirely within the remaining left lobe and isthmic tissue. There was no significant uptake elsewhere.

In the hope of destroying the remaining inoperable thyroid tissue still present in this patient a dose of 50 millicuries of I^{131} was administered. Tracer studies repeated three and one-half months later revealed localization of a significant amount of radioactivity in the right hemithorax. Accordingly, a therapeutic dose of 79 millicuries of I^{131} was administered. Serial chest films made over the period of July to December, 1951, showed no appreciable change in the appearance of the densities in the right lung. On November 2, 1951, two hard, moderate sized lymph nodes were removed from the right anterior cervical lymphatic chain and the pathologist's report was "metastatic deposits of well differentiated (colloid) thyroid tissue—papillary adenocarcinoma." Figure 2 is a low power view of a strip film autograph of a section of one of the cervical lymph nodes.

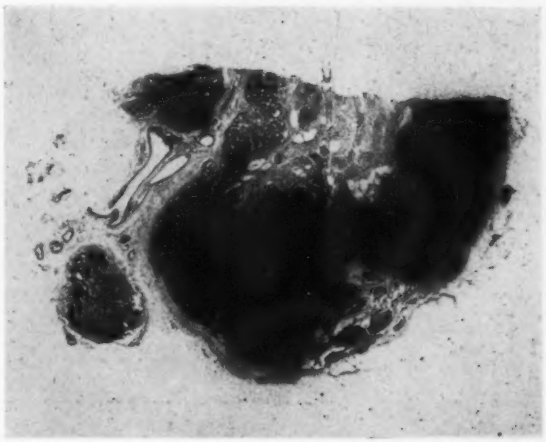

Fig. 2. Low power view of strip film autograph of section of cervical lymph node removed on November 2, 1951.

Fig 3. Chest radioautograph, one hour exposure with patient supine on cassette with intensifying screens and conventional roentgen film.

Technical Data Concerning Chest Radioautography

On December 13, 1951, six days after the administration of the 79 millicuries of I^{131}, approximately 11 per cent of the therapeutic dose was recorded in the neck† and approximately 90 per cent of the I^{131} had been excreted in the urine. The patient's height was 1.55 meters, her weight 36.4 kilograms and the posteroanterior

* The artificial radioisotope therapy work with this patient was carried out by the Radioisotope Laboratory of the Beth Israel Hospital, Boston, Mass. The author is greatly indebted to them for help and advice in the cooperative care of this patient.

† A small error is introduced into the estimation of radioactivity in the neck due to difficulty in eliminating an effect on the neck measurements by radioactivity from the thorax.

FIG. 4. Chest radioautograph with mask over mediastinum and chest walls enabling observer to concentrate attention on photographic effect of radioactivity present in right lung.

measurement through the chest at the level of the sixth dorsal vertebra was 19 cm.

The patient was placed supine on a 14 by 17 inch cassette with par-speed intensifying screens and housing a 14 by 17 inch Eastman Kodak blue brand medical x-ray film. At the end of one hour the film was processed and the resulting chest radioautograph is shown in Figure 3. In Figure 4 the radioautograph in Figure 3 is superimposed or inlaid on the conventional posteroanterior roentgenogram shown in Figure 1. The photographic effect of the radioactivity present in pulmonary metastases in the right lung and right hilus is clearly shown.

A similar chest radioautograph was prepared by placing the patient supine upon a 14 by 17 inch cardboard exposure holder housing a 14 by 17 inch Kodak blue brand x-ray film. At the end of one hour the film, upon processing, showed a definite blackening with the distribution of this photographic effect conforming to that of the radioautograph made with cassette and intensifying screens but the degree of blackening was far less with the cardboard holder. It was not of sufficient density, however, to be clearly noticeable on a glossy print reproduction for illustration purposes in this report.

By means of a photoelectric cell light meter, GE exposure meter (Type DW-68) readings taken over the areas of maximum blackening on the two films were as follows:

Radioautograph with cassette and films.... ..... 4.5 divisions on the scale.
Radioautograph with cardboard holder..... .....35.0 divisions on the scale.

A difference in blackening of the films when measured by an ordinary photographic light meter of a factor of 7 indicates the contribution from the intensifying screens to the photographic effect obtained in the chest radioautograph. Intensifying screens serve the same useful purpose for chest radioautography that they do in conventional roentgenography.

DISCUSSION

Chest radioautography as defined here is a practical and useful procedure and may, as in the case here reported, be of distinct help in the differential roentgen diagnosis of pulmonary lesions as well as *providing a topographical localization of metastatic lesions in the chest.*

Cassette and film used in conventional roentgenography are all that is required to carry out the procedure. If cassette with intensifying screens is used, one hour exposure time is required for a satisfactory chest radioautograph in a patient with the height, weight and chest thickness measurements here reported.

The chest radioautograph reproduced in Figures 3 and 4 demonstrates again that the conventional medical roentgen film emulsion is an excellent radiation detector but, because roentgen film emulsion is fast and consists of coarse granules, it gives a poor resolution.*

* Radioactive I^{131} yields two types of gamma-ray energy in respect to wavelength characteristics. One type, the majority of gamma rays from this isotope, has wavelength characteristics equivalent to 367 kv. (peak) roentgen rays. The second type gamma radiation has wavelength equivalent to 80 kv. (peak) roentgen rays but there is a far smaller quantity of the second type and in all probability none of the second type get outside the patient's skin to affect the film emulsion.

Roentgen film emulsion is here demonstrated to be a successful radiation detector in the localization of relatively low amounts of radioactivity present in pulmonary structures at a distance of at least 10–12 cm. from the cassette and film.

Perhaps other workers with the requisite physical instruments and mathematical skill and with access to clinical cases of malignancy undergoing radioisotope therapy will investigate this method further, improve upon it and possibly investigate the quantitative estimation of the density of the chest radioautographic images.

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TELEPAQUE*

A NEW CHOLECYSTOGRAPHIC MEDIUM WITH IMPROVED VISUALIZATION OF THE GALLBLADDER AND VISUALIZATION OF THE BILE DUCTS

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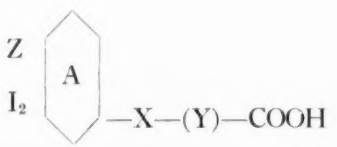
ORAL cholecystography provides a reliable and indispensable method of examination of the gallbladder, which has gained wide recognition. In 1924 Graham and Cole[9] introduced intravenous cholecystography and, soon after, oral cholecystography.[10] Great strides have since been made. Many refinements in procedure and technique have been added, and a fairly well established routine is now widely used. Tetraiodophenolphthalein has been replaced largely by iodoalphionic acid (priodax), a product that has proved satisfactory in many ways. Though it has fewer side reactions, they are of sufficient degree and frequency to be objectionable and to warrant definite attempts to find a better cholecystographic medium. Other compounds have been prepared but were no improvement over priodax. Some were tested in this department and found unsatisfactory. The search for a better cholecystographic medium continued.

An ideal cholecystographic medium should meet the following minimal requirements:

1. Absence of systemic toxicity, or at the most a very low level of toxicity.
2. Early and rapid absorption and absence of irritation to the mucosal surface of the gastrointestinal tract.
3. Selective excretion in the bile, and, consequently, localization in the gallbladder.
4. Sufficiently high content of radiopaque material to insure adequate roentgenological visualization.
5. Reliable results following oral administration.
6. Rapid and complete elimination.

As a result of their studies on a large number of iodinated compounds for the purpose of visualizing the gallbladder in experimental animals, Archer and Hoppe and associates[1,2,12,13,14] observed that adequate visualization could be obtained with compounds conforming to the following general formula:

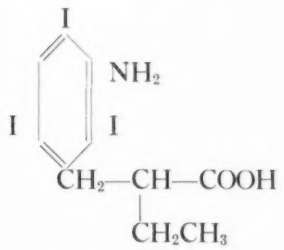


where

$Z = NH_2$ or OH
$X = CH_2$, S, CONH, SO_2NH, CH=CH
Y = lipophilic group
A = aromatic ring

They further concluded that a satisfactory cholecystographic medium should contain (a) a high iodine content, for visualization of the gallbladder, (b) a lipophilic group of optimum size to direct excretion through the bile, into the gallbladder, rather than into the kidney, and (c) an optimum balance between lipophilic and hydrophilic groups in order to obtain adequate absorption from the intestinal tract. With optimum configuration and two iodine atoms in the molecule, visualization approximately equivalent to that of iodoalphionic acid was obtained. It became apparent that if visualization were to be improved, it would be necessary to increase the radiopacity of the molecule. This was accomplished by adding a third iodine atom to the molecule. In a study of a series of triiodo alkanoic acid derivatives, it was found that the following compound,

* Supplies of Telepaque were provided by the Department of Medical Research, Winthrop-Stearns, Inc.



3-(3-amino-2,4,6-triiodophenyl)-2-ethylpropanoic acid (telepaque), containing 66.68 per cent iodine, was about 1.5 times as effective as iodalphionic acid in visualizing the gallbladder in experimental animals. This is confirmed by the roentgen studies made on our patients. Acute toxicity studies in mice revealed that oral toxicity of telepaque was about one-fourth as great as that of iodoalphionic acid. Repeated oral doses of 1 gram per kilogram were tolerated without evidence of gastrointestinal irritation or effect on liver or kidney function in dogs. In view of the effective visualization of the gallbladder and its low toxicity, telepaque appeared to merit extensive clinical evaluation as a cholecystographic medium. This new chole-

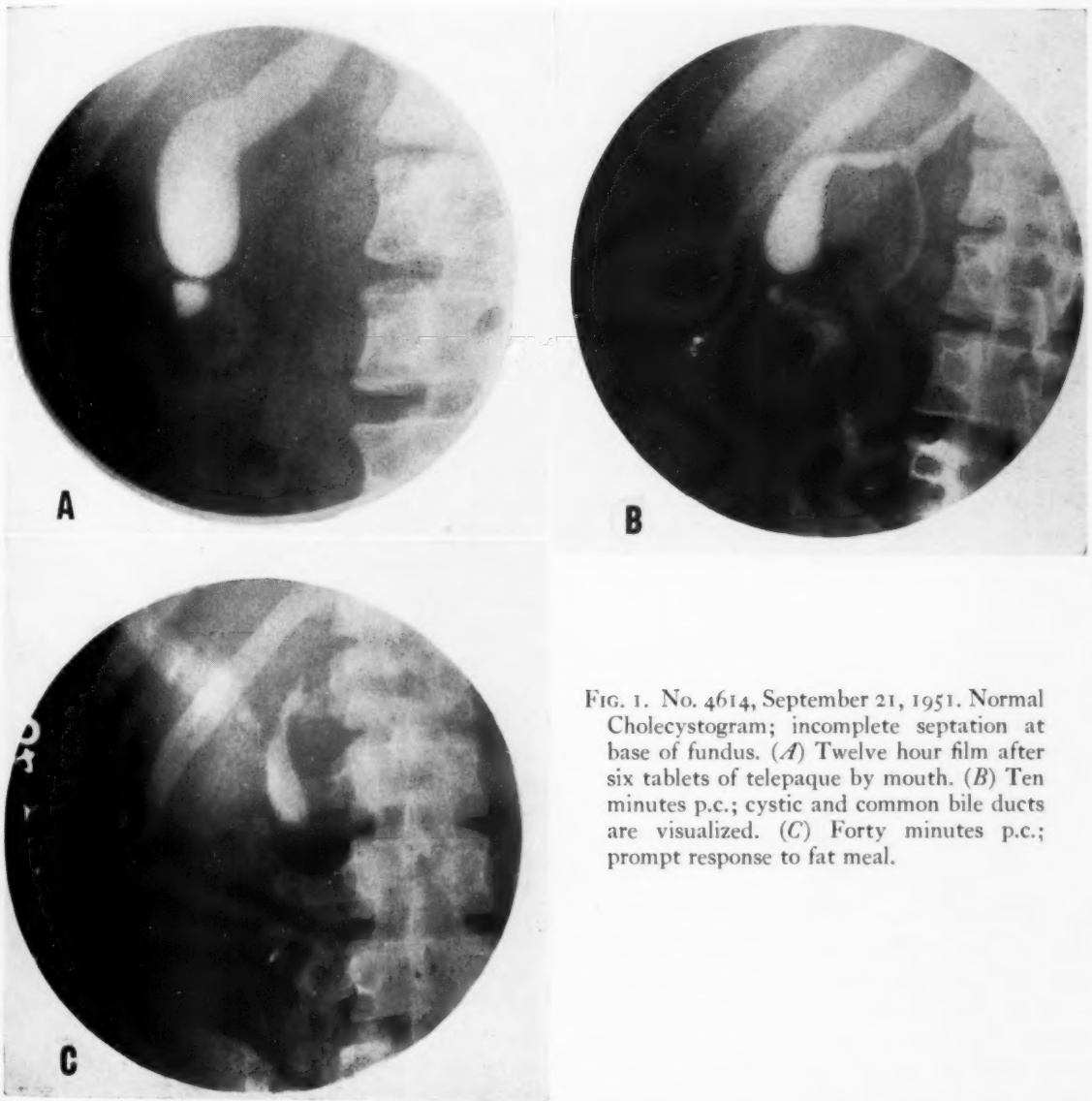


FIG. 1. No. 4614, September 21, 1951. Normal Cholecystogram; incomplete septation at base of fundus. (*A*) Twelve hour film after six tablets of telepaque by mouth. (*B*) Ten minutes p.c.; cystic and common bile ducts are visualized. (*C*) Forty minutes p.c.; prompt response to fat meal.

cystographic medium has been used in a series of 310 patients recently examined in this department. Based on the observations made on this series, telepaque is considered to be a cholecystographic medium of choice, superior to any that has as yet been used.

CHEMICAL AND PHYSICAL PROPERTIES

Telepaque is a cream-colored solid which contains 66.68 per cent iodine by weight (compared with priodax 51.38 per cent,

FIG. 2. No. 2135, April 24, 1951. Normal gallbladder and ducts (cystic and common) forty minutes p.c. Note uniform caliber of ducts and small amount of contrast medium in the duodenum.

monophen 52.2 per cent, tetraiodophenolphthalein 61.6 per cent). It melts at 155–157° C. It is insoluble in water, but is soluable in dilute alkali and 95 per cent alcohol and other organic solvents.

ABSORPTION

Telepaque is readily absorbed from the small intestine, evidently through the portal circulation into the liver, and is then excreted in the bile. Within two hours after oral administration, it is already in the gallbladder, as demonstrated by roentgenograms made at hourly intervals. Optimal density and best visualization are obtained at about ten to twelve hours. A small residue of telepaque is not infrequently seen in the cecum and ascending colon. In none of the cases examined did this overshadow the gallbladder area or interfere with visualization of the gallbladder.

EXCRETION

Telepaque is excreted mostly through the intestinal tract. Up to 85 per cent of the total ingested was recovered from the feces of experimental animals, and from 2.1 to 4.9 per cent was excreted in the urine. Traces were found in the internal organs, mostly in the liver.

When priodax is used for cholecystography, it is reabsorbed from the intestines and appears in the gallbladder, in steadily decreasing density, over a period of three to five days. When telepaque is used, such occurrence is infrequent, since this contrast medium is more rapidly and completely eliminated.

CLINICAL OBSERVATIONS AND EVALUATION

Telepaque, as a cholecystographic medium, is well tolerated by patients. Side reactions are far less pronounced than with any of the other cholecystographic media. In a number of cases, the gallbladder was adequately visualized with telepaque when it failed to visualize, or visualized poorly, with other contrast media. Fewer patients required a second dose.

Two series of 120 cases each were examined simultaneously, using telepaque and priodax respectively. The side reactions following the use of telepaque were much less pronounced than with priodax (Table 1), there being marked decrease in diarrhea, burning on urination, nausea, and vomiting. Reporting on a similar series of 116 cases of telepaque and priodax, respectively, Dunne and his co-workers[5] arrive at essentially the same conclusion.

A parallel series using monophen was started but was soon discontinued. Using a 3 gram dose of each, the shadow obtained with monophen was much less pronounced

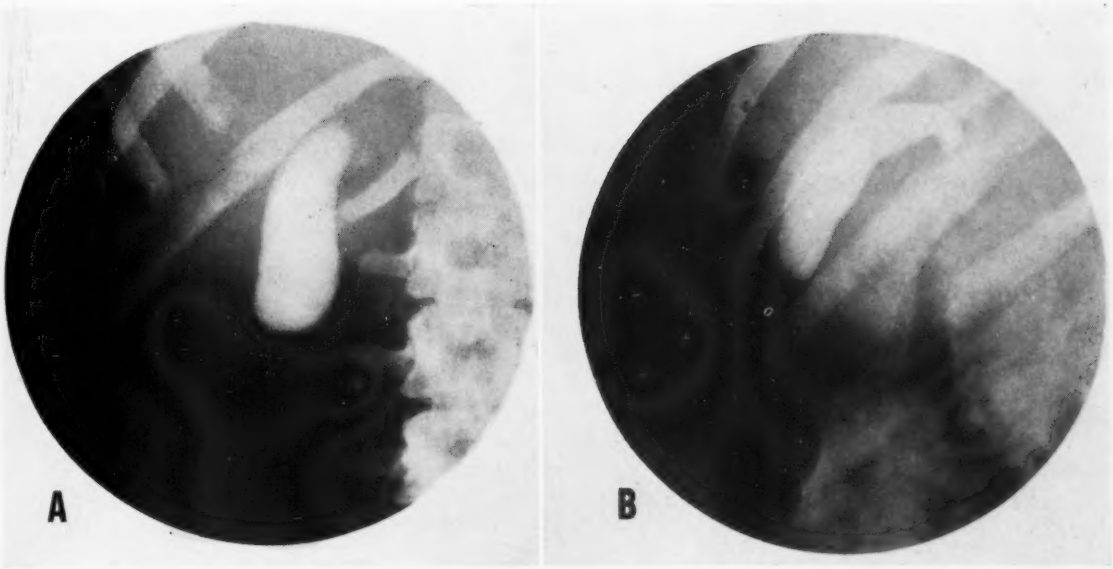


Fig. 3. No. 5733, November 24, 1950. (*A*) Normal gallbladder filling twelve hours after oral intake of six tablets of telepaque. (*B*) Ten minutes p.c.; anteroposterior supine view, left side elevated 10 degrees; note uniform filling and caliber of the ducts; also, contrast medium in duodenum demonstrating normal folds.

than with telepaque. Furthermore, patients found it much easier to take telepaque in tablet form, than monophen in capsules, which is the form in which it is dispensed. Monophen may be comparable with, but is not superior to, priodax.

Prior to the cholecystographic examination, each patient is carefully questioned as to occurrence of nausea, vomiting (number of times), diarrhea (number of times—one loose bowel movement is considered diarrhea), burning on swallowing, burning on urination, skin eruptions and pruritus. These were graded 1–4 plus, according to frequency and intensity. In interpretation of the cholecystograms the gallbladder shadow is evaluated as to (1) size, 1–4 plus, where 4 plus represents what is considered the upper limit of normal in size; (2) density, 1–4 plus (poor, fair, good, excellent) where 4 plus is considered upper limit of "normal" density for the dose and contrast

Table I

SIDE EFFECTS WITH 3 GRAMS OF TELEPAQUE AND PRIODAX OBSERVED AT NEW YORK POLYCLINIC HOSPITAL

	No. of Cases	Nausea	Vomiting	Diarrhea	Burning on Swallowing	Burning on Urination	Skin Eruption	Pruritus
Telepaque	310	10%	0.3%	15%	5%	6%	—	—
Priodax	120	25%	5%	32%	20%	25%	2.5%	2.0%

SUMMARY OF SIDE EFFECTS WITH PRIODAX REPORTED BY VARIOUS AUTHORS

Fong[6]	250	23%	1%	43%		50%		
Ochsner[16]	300	26%	2.6%	15%		5%		
Bryan and Pedersen[3]	845	20%	2.0%	33%		12%		
Paul, Pohle, and Benson[18]	114	28.1%	1%	22.8%		15%		
Ochsner[17]	600	24.6%	5%	14%		5%		

medium used, with sharp outline and excellent contrast. One plus represents poor density with faint visualization of the gallbladder; (3) size of the gallbladder, 1–4 plus, after a fat meal (Table II); (4) the presence of calculi or any other abnormality; (5) absence of visualization of the gallbladder; (6) extent of visualization of the bile ducts.

DOSAGE AND METHOD OF EXAMINATION

Telepaque is prepared in 0.50 gram tablets. Six tablets are dispensed in one tube for a single dose.

Of the 310 cases studied, 250 received six tablets (3 grams) and 60 received twelve tablets (6 grams). Doses of eight, nine, and ten tablets presented no special advantage. Doses smaller than 3 grams are being studied at present.

As was predicted from the study of its structural formula, with its high iodine content, the density of the gallbladder shadow is greater with telepaque than with priodax and monophen, being 1.46 times higher than with priodax.

With twelve tablets of telepaque a greater density of the gallbladder shadow is noted. The ducts are better and more frequently visualized. For routine studies of the gallbladder, however, this dose is not indicated, except possibly in very obese patients.

Its value in the study of the normal and abnormal bile ducts is significant, and will be presented in a subsequent report.

A preliminary roentgenogram is made in the usual manner, the day before the examination, and a low fat meal is given that same evening. When priodax is used, this meal is served to hospital patients at about six o'clock. Six tablets (3 grams) are taken after supper, one at a time, at about five minute intervals. After that, nothing is given by mouth, except water, until after the examination at 9:00 o'clock the following morning. When telepaque is used, hospital patients still have their supper served at six o'clock, followed by the tablets, while ambulatory patients may have their evening meal any time between six and nine o'clock.

TABLE II

VISUALIZATION OF THE GALLBLADDER

	Size		Density		Size after Fat Meal	
	Telepaque	Priodax	Telepaque	Priodax	Telepaque	Priodax
4+	43%	25%	30%	11%	0	1.3%
3+	34%	50%	42%	49%	3%	13%
2+	3%	2.6%	6%	12.6%	16%	26%
1+	1%	1.8%	4%	6.3%	63%	38%
Nonvisualization	18%	21%				

Absorption studies on our patients have demonstrated that optimal density of the gallbladder shadow is reached at about ten to twelve hours after oral administration of telepaque. Since the morning examination is performed at 9:00 o'clock, this would permit out-patients to take the tablets at about 9:00 p.m. It seemed more convenient to give in-patients telepaque after supper. There is no disadvantage in having the examination done fourteen to fifteen hours, instead of twelve hours, after oral administration of this cholecystographic medium.

At 9:00 a.m. films are made in the posteroanterior, left oblique prone and posteroanterior upright positions. These are developed immediately and inspected. Additional views are made as needed. When indicated, prostigmine is administered to dispel overlying intestinal gas.

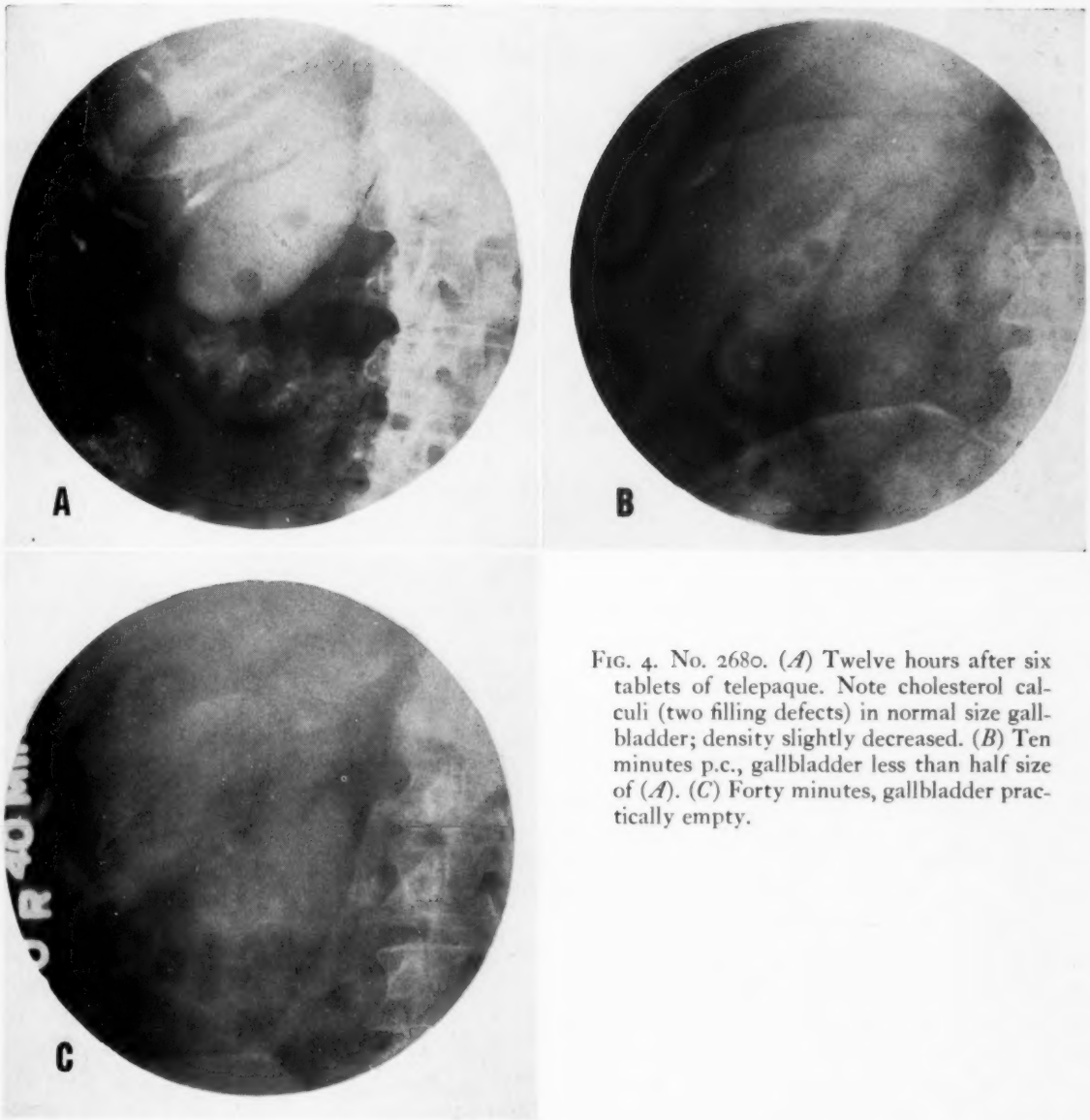


Fig. 4. No. 2680. (*A*) Twelve hours after six tablets of telepaque. Note cholesterol calculi (two filling defects) in normal size gallbladder; density slightly decreased. (*B*) Ten minutes p.c., gallbladder less than half size of (*A*). (*C*) Forty minutes, gallbladder practically empty.

A fat meal is given in the department where the patient waits until the next films are made. (The fat meal consists of an 8 ounce eggnog, containing the yolk of two eggs and 2 ounces of cream.) After forty minutes, films are made in the prone posteroanterior and left oblique positions. At this time a normal gallbladder will have contracted to about one-fourth of its original size; occasionally it is almost empty. Priodax seems to delay, or interfere with gallbladder emptying. Copleman[4] and Golden[7] noted that the contraction of the gallbladder after the stimulus of a fat meal is slower and appreciably less with priodax than with tetraiodophenolphthalein. This may mask calculi or other abnormalities. Emptying of the gallbladder is more rapid and more complete with telepaque than with any of the other cholecystographic media.

The biliary ducts are visualized in about half of the patients examined. The ducts are practically equidistant from the anterior and posterior abdominal walls. Roentgenograms made in the supine position, with the

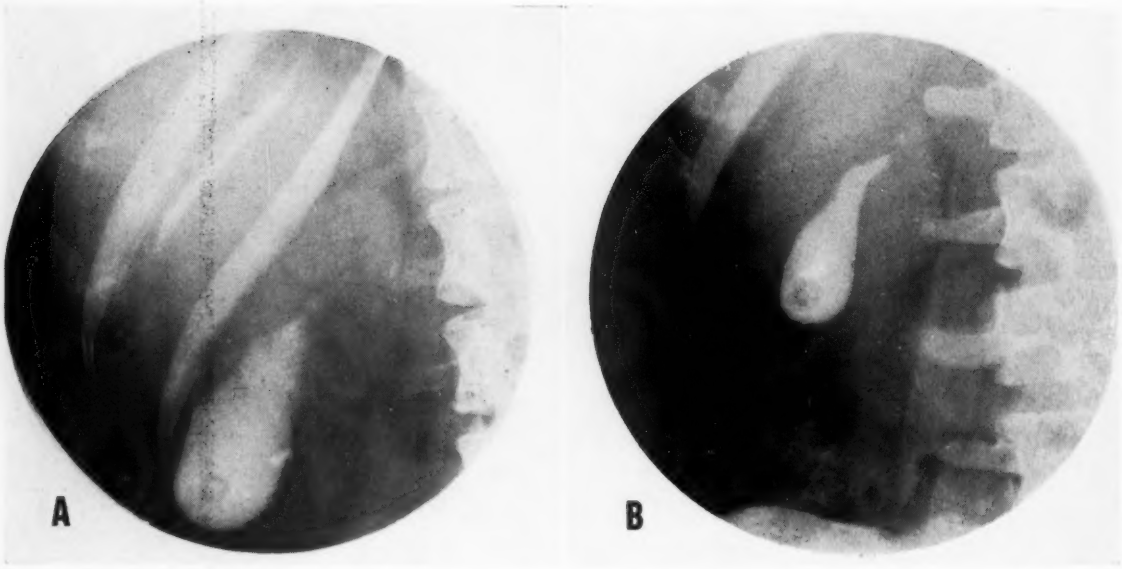


FIG. 5. No. 3840, July 17, 1951. (*A*) Twelve hours after six tablets of telepaque; note cholesterol calculus with central opaque nucleus clearly visualized. (*B*) Forty minutes p.c.; prompt response to fat meal.

left side of the body elevated 10 to 15 degrees will "unfold" the ducts, bringing about more adequate visualization. This view has been added to our routine, with films made ten to fifteen minutes p. c.

Hitherto, by means of cholecystography, radiologists have evaluated the condition of the gallbladder by (a) the presence or absence of filling; (b) the intensity of the gallbladder shadow, as an index of bile concentration; (c) the rate and extent of emptying of the gallbladder after administration of a fat meal; (d) the presence of calculi or other abnormalities in the gallbladder. When using telepaque, visualization of the bile ducts occurs with sufficient frequency to make this a satisfactory, convenient and valuable procedure for the study of their normal and abnormal anatomy and physiology, thus opening a new field in the study of the biliary system. In this manner, the bile ducts are visualized in their natural and "undisturbed" state, and not through the influence of medication administered to produce a spasm of the sphincter of Oddi, or by means of cholangiography in the operating room. It is now possible to speak of "nonsurgical" or "oral" cholangiography, as contrasted with surgical or operative cholangiography. Eventually, a technique will be evolved whereby more uniform and constant visualization of the ducts will take place. Prior to this study, I have used priodax since 1943, and more recently, and to a lesser extent, monophen. No such visualization of the bile ducts was observed with either cholecystographic medium.

CONCLUSION

Telepaque 3-(3-amino-2,4,6-triiodophenyl)-2-ethyl-propanoic acid is a new compound which seems to satisfy the requirements of an ideal cholecystographic medium better than any of the media now used for cholecystography, and for that reason is considered superior.

Based on observations made on a nonselected series of 310 cases, telepaque presents the following features:

1. A decidedly low level of side reactions.
2. Ready and rapid absorption, prompt response of the gallbladder to a fat meal, and rapid elimination from the system.
3. Greater density and improved visualization of the gallbladder.

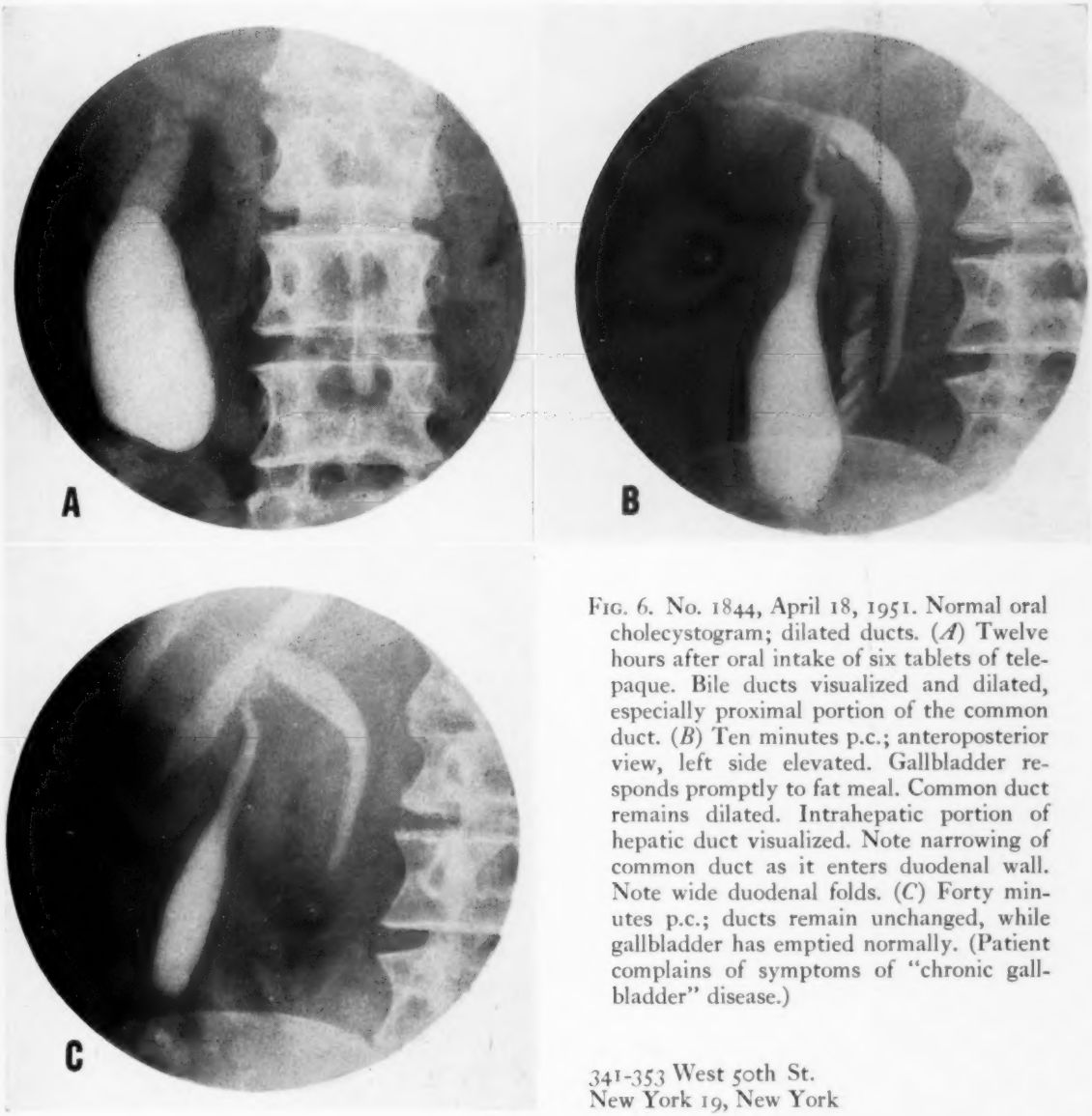


Fig. 6. No. 1844, April 18, 1951. Normal oral cholecystogram; dilated ducts. (*A*) Twelve hours after oral intake of six tablets of telepaque. Bile ducts visualized and dilated, especially proximal portion of the common duct. (*B*) Ten minutes p.c.; anteroposterior view, left side elevated. Gallbladder responds promptly to fat meal. Common duct remains dilated. Intrahepatic portion of hepatic duct visualized. Note narrowing of common duct as it enters duodenal wall. Note wide duodenal folds. (*C*) Forty minutes p.c.; ducts remain unchanged, while gallbladder has emptied normally. (Patient complains of symptoms of "chronic gallbladder" disease.)

4. Frequent visualization of the bile ducts. This introduces a new field in the study of the biliary tract.

At this time the recommended dose is six tablets (3 grams), to be given ten to twelve hours before the scheduled examination. For very obese patients a twelve tablet (6 grams) dose may be indicated.

Further studies of a four and five tablet dose (2 and 2.5 gram doses) may suggest the advisability of a smaller dose for cholecystography.

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CLINICAL AND ROENTGENOLOGICAL MANIFESTATIONS OF THE KLIPPEL-FEIL SYNDROME (CONGENITAL FUSION OF THE CERVICAL VERTEBRAE, BREVICOLLIS)

REPORT OF EIGHT ADDITIONAL CASES AND REVIEW OF THE LITERATURE

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INTRODUCTION

THE Klippel-Feil syndrome is a term which has been used extensively in the literature to denote a clinical condition characterized by congenital fusion of two or more cervical vertebrae. There are usually other associated congenital anomalies of the spine and other portions of the skeleton, and in some instances neurological disturbances. It is important in the differential diagnosis of pain or deformity of the neck and in the analysis of neurological symptoms referable to the cervical segments of the spinal cord.

Hutchinson[35] in 1894 and Clarke[17] in 1906 reported cases of the syndrome. However, the condition is generally named after Klippel and Feil as they were the first to record a complete clinical description with subsequent postmortem studies. In 1912 a forty-six year old tailor ill in a Paris hospital with pleurisy and nephritis attracted the attention of Klippel and Feil because of an unusually short neck. The head seemed to rest directly on the shoulders and its mobility was markedly limited, especially laterally. The hair line extended to the superior apsect of the thorax.[41,42] The patient died and it was discovered at postmortem examination that there were only four cervical vertebrae. These were fused into a single column of bone. Each vertebra had bilateral cervical ribs and posterior spina bifida. They termed the lesion a "cervical thorax."

In 1919 Feil[26] collected and reviewed all the previously reported cases and outlined the characteristics of the syndrome. He divided the condition into three types; (1) those with complete fusion of the cervical spine; (2) cases of partial coalescence of the cervical segments; and (3) those with reduction of the number of cervical vertebrae and fusions and anomalies in other parts of the spinal column. In the French literature the cases are designated "hommes sans cou," or "telescopage vertebrale," and in the German "Kurzhals."[39,31] Feil's essential clinical manifestations comprised shortness of the neck, low implantation of the hair line, and limitation of the motions of the head and neck. The secondary characteristics, which he did not find in every instance, consisted of scoliosis or kyphoscoliosis, elevation of the scapula, descent of the nipples, torticollis of muscular or osseous origin, and disproportion of the length of the extremities which resulted in a simian-like appearance.

REVIEW OF THE LITERATURE

Inasmuch as approximately only 65 authentic clinical cases have been described in the English literature and about an equal number in the foreign literature, it is of interest to present a review of the previously reported cases and record 8 additional cases.

Etiology and Embryology. Klippel and Feil originally considered that the syndrome was brought about by intrauterine inflammation or trauma.[41,42] Feil[26] later stated it was a high spina bifida and that pressure and trauma during fetal life caused the deform-

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ity. Hereditary syphilis was implicated by others.[9,62,65] Cave,[15,16] an anatomist, carried out studies on the orang, dog, mantee, and other lower animals. He also studied 24 dissected human fetuses and suggested that the fusions were an attempt at formation of a cervical sacrum to better support the weight of the head. Noble and Frawley[54] theorized that in the course of evolution the craniovertebral articulation had been shifted backward with absorption of several vertebrae into the skull to form a postotic segment. In 1943 Saunders[66] expressed the opinion that a double or split notochord was the cause of this type of abnormality. Neuhauser *et al.*[52] recently described several cases of diastematomyelia or congenital sagittal division of the spinal cord or cauda equina with associated anomalies of development of the vertebrae. Although their cases were characterized by deformities of the thoracic vertebrae, the bony anomalies were similar in character to those which occur in the cervical segments in the Klippel-Feil syndrome. The significance of the cases of diastematomyelia is that they seem to lend support to the split notochord theory. There have been multiple instances in one family which strongly suggests a mendelian pattern. There are several notable examples of this. Sicard and Lermoyez[68] report analogous changes in a mother and 4 children; Feil,[26] in a father and son; and Erskine[24] describes an instance previously reported by Kallius[39a] in a father and 3 children. Others have reported cases in which there were affected 2 brothers and a sister,[21] a mother and a daughter,[18] and sisters.[24]

The most generally accepted opinion is that the syndrome is the result of a widespread failure of normal segmentation of the mesodermal somites.[49,69] In the third week of development of the fetus, paired masses of mesoderm on each side of the closing neural tube become divided progressively into paired lateral segments, the so-called mesodermal somites.[57] The cells of each somite become arranged about a central canal, the myocoele.[5] The ventromedial wall of the somite, termed the sclerotome, breaks down and its cells, together with those in the myocoele, stream toward and surround the notochord.[3,11,40,49,57] These cells tend to cluster around the notochord, the cells from each group being formed from two adjacent pairs of somites. The intersegmental clusters consolidate and from them extend paired lateral and dorsal processes which become respectively the transverse processes and the neural arches.[57] Chondrification centers develop to form a cartilaginous vertebra, and in the seventh week of fetal life ossification centers form, one, or according to some authors two,[3,40] for the centrum, one for each neural arch, and one for each costal process. The central and neural ossification centers meet and fuse in the fourth or fifth year of life. The determination of the exact etiology of the Klippel-Feil syndrome and its related defects must await further research into the abnormal fusions and migrations of sclerotomal cells during the third to seventh weeks of development of the fetus. Ingalls[36] reduced the atmospheric pressure to which 300 pregnant mice were subjected during the early days of pregnancy and produced various specific bony congenital defects in the 2,500 embryos. Certain skeletal anomalies were produced by subjecting the mother mouse to anoxia on the eighth day of pregnancy. The congenital elevation of the scapula is apparently secondary to the primary vertebral lesions as elongation of the neck and descent of the scapula do not occur before the ninth week of development of the embryo. The embryology of the vertebrae and intervertebral discs has been well described by Beadle[8] and Jordan and Kindred.[39] Mercer[48] in 1950 demonstrated indentations of the anterior aspects of the vertebral bodies which he believed were due to delayed fusions of the primitive notocordal segments.

Pathology. Postmortem studies have been performed on less than 10 of the reported cases. The original case of Klippel and Feil died of pneumonia. pleuritis and nephritis, all of which were unrelated to the syndrome.[41,42] Jarcho and Levin[38] describe normal spinal cord sections in their case. Avery and Rentfro[4] recorded the case of an infant that died thirty-five days after birth of inanition and pneumonia. At postmortem there was found a cleft involving the occipital bone and the cervical and first four dorsal neural arches with enlargement of the foramen magnum and prolapse of the medulla and cerebellum. Microscopic sections showed a division of the upper part of the spinal cord by a deep anterior fissure, doubling of the lower portion of the canal, and a moderate degree of gliosis.

Clinical Manifestations. The clinical manifestations are produced by the vertebral fusions, the multiple and varied congenital anomalies which accompany the syndrome, and the neurological disorders which ensue from torsion and compression of nerve roots.[63] The condition may be found at any age and cases have been recorded from birth to seventy years. Those with fusion of only two or three cervical vertebrae, the type two of Feil, are asymptomatic and are usually discovered only at postmortem, in the dissecting room, or on roentgen examination.[1,15,16,53] The variations in the clinical picture of the Klippel-Feil syndrome are so great that this aspect of the condition can best be discussed in regional groupings.

a. Central nervous system: In 1926, Critchley[20] presented a patient with the Klippel-Feil syndrome in whom there was syringobulbia and syringomyelia. Deaf mutism,[27] synkinesia,[7,72] paralysis of the third,[4] sixth and seventh cranial nerves,[70] hereditary ataxia of the Marie type, Friedreich's ataxia,[43] nystagmus,[43] spastic paralysis of the right arm, sphincteric disturbances and neurotrophic disturbances of the joints,[12] have been found. In the case reported by Bauman[7] in 1932, the patient showed marked mental weakness. Both of Hudson's patients were psychotic

and were committed for schizophrenia.[34] Latto[43] in 1942 reported a case with nystagmus and meningocele in the cervical region. In 1947 Dyke[23] described a patient with the Klippel-Feil syndrome in whom there was a dermoid cyst of the upper cervical region which produced obstruction to the flow of cerebrospinal fluid. There was resultant hydrocephalus and separation of the cranial sutures. In the same year Bucy and Ritchey[14] published a description of a thirty-two year old male with progressive hypesthesia and weakness of the legs. At laminectomy a hemangiolipoma, at first considered to be a congenital dysplasia, was excised, with subsequent improvement of the symptoms. Other neurological disturbances which have been reported in association with the Klippel-Feil lesion are Horner's syndrome[63] and constrictive radiculitis of the cervical roots due to narrowing of the foramina.[63,64]

b. The face, oral cavity, and ears: Noble and Frawley[54] in 1925 reported the occurrence of cleft palate. More recently micrognathia has been described by two authors[21,46] and abnormal dentition by Willard and Nicholson.[72]

c. The neck: In most instances there has been coalescence of more than two cervical vertebrae.[48,56] Turner *et al.*[71] were of the opinion that flexibility of the spine is not disturbed if four or more intervertebral discs remain unaffected. Pterygium colli or webbed neck, in which the trapezii are widely flared from the mastoid prominences to the acromium processes, was of frequent occurrence.[24,27,28,31,70] Torticollis of bony or muscular origin has been reported by six authors.[7,20,46,55,69,70] In Mitchell's patient there was abnormal downward angulation of the lamina in the cervical region, leaving uncovered a segment of the cord extending from the occiput to the level of the fifth cervical vertebra.[51]

d. The thorax: Elevation of the scapula, so-called Sprengel's deformity, was of such frequent occurrence that many authors considered it an essential part of the syndrome.[2,18,21,22,25,29,31,49] Two of Frawley's patients had webbed arm pits.[28] Funnel chest[10] and low nipple line[24] have been reported. When severe, dorsal kyphoscoliosis may produce marked respiratory difficulty.[28,38,47] Buchman,[13] in 1937, stated that Klippel-Feil syndrome may be associated with platyspondyly.

e. Visceral manifestations: Mitchell,[50] in 1934, reported a case with patent foramen ovale and interventricular septal defect. Bizarro's patient[10] presented the signs and symptoms of pulmonary stenosis and had undescended testicles. Rinvik[63] in 1943 described a twenty-three month old infant female with fat doughy fingers, cleft pelves of the kidneys, and the Klippel-Feil syndrome.

f. The extremities: In 1928 Ingelrans and Piquet[37] presented a case of a fourteen year old female with absence of the external auditory meatus, facial asymmetry, and malformation of the forearm and thumb. Rechtman and Horwitz[62] have described club foot, club hand, and pseudomyopathy in association with the syndrome.

Roentgen Manifestations.

a. Cervical region: Erskine[24] in 1946 stated that the most significant roentgen features comprise synostosis of the cervical vertebrae, flattening and widening of the vertebral bodies, narrowing or obliteration of the intervertebral discs, shortening of the cervical spinous processes, spina bifida, and fusions and deformities of the ribs. In addition to coalescence of the cervical vertebrae,[58,60] spina bifida occulta is the most frequent anomaly which has been recorded.[2,9,18,21,30,44,46,47,61–63,67,69] Cervical ribs have been reported by Allen,[2] Clarke,[17] Clemmesen[18] and Demeler.[21] Hemivertebrae in the cervical and thoracic spine have been described in several instances.[29,30,44]

b. Skull: Oxycephaly[59] and platybasia[29] have been described in association with the Klippel-Feil syndrome.

c. Thorax: Among the most common deformities accompanying the Klippel-Feil syndrome are fusions of the ribs[38] and variations in the number of ribs on the two sides.[67]

Differential Diagnosis. The patient with the head thrust forward on a short, broad neck may suggest the diagnosis of congenital torticollis, tuberculosis, or syphilis of the cervical vertebrae. Ritvo[64] has observed that the patient with the Klippel-Feil syndrome has painless limitation of motions of the head and neck.

Treatment. Most authors have expressed the opinion that no treatment was indicated.[51,64] Steindler[69] stated that attempts to increase neck motion by manipulation may prove harmful. Bauman[7] has reported the beneficial effects of cervical traction in a patient with swelling, heaviness, and stiffness in one arm. Thomson[70] prescribed remedial exercises to a young girl with a forward thrust of her head. Intermittent hyperextension of the neck and dorsolumbar spine during a period of several months produced apparent improvement according to the photographs reproduced in his report. One of our patients is performing these exercises, but it is still too early to determine whether they will prove beneficial. Lewin[45] has noted an instance in which the outer portions of the trapezii were resected for cosmetic reasons. He described another patient who was treated by the application of a cotton collar which partially detelescoped the head and neck.

Prognosis. No long term follow-up studies have been reported as the syndrome rarely causes death and usually remains stationary for many years.[7,32] Death may rarely result from the associated congenital defects. Of Mitchell's 6 cases, one died at five weeks and another six weeks after birth from inanition and pneumonia.[50]

FIG. 1*A*. Case 1. Photograph of the patient at the age of forty. The neck is short and broad. The right arm and shoulder show a marked degree of atrophy. The right side of the chest is smaller than the left. The right nipple is decreased in size and pigmentation.

REPORT OF CASES

CASE 1. S. A. (No. 998,149), a forty year old male elevator operator, was admitted September 15, 1939, with a history of progressive neurological disturbances extending over the past twenty-five years. In 1914, at the age of fifteen years, he developed paralysis of the right arm which became progressively worse and later involved the right leg. At that time there was no loss of sphincter control, pain, or sensory disturbance. He remained in the hospital for one year during which time the paralysis cleared almost completely. Since that time he had been free of symptoms except for weakness of the right arm and leg. Hemiatrophy on the right was present constantly throughout this interval. Beginning in 1931, when he was thirty-two, there gradually developed severe burning pain in the right side of the neck, the external aspect of the right arm, and right side of the thorax posteriorly extending down to the level of the tenth dorsal vertebra. When about thirty-four, he found that he had suffered several unnoticed cigarette burns of the fingers of the left hand. A Hinton test in 1937 was positive and antiluetic therapy was administered without reversal of blood changes.

He again entered the hospital in 1939, complaining of pain in the right side of the neck, weakness, and intermittent vertigo. At this time the right arm and leg were smaller in circumference, shorter in length, and weaker in muscle power than the left. The tendon reflexes were hyperactive on the right. There was bilateral Babinski reflex and past pointing. Astereognosis of the right hand was present to a marked degree. He was unable to distinguish hot and cold in the areas of the skin supplied by the left fourth to eighth cervical nerves. Fibrillary twitchings were present in the right shoulder and arm. There was lateral nystagmus with a rotary componenton both sides. Roentgen study revealed multiple congenital abnormalities with bony defects and coalescence of the first to fifth cervical vertebrae. The dens was tilted to the right and angulated. The arch

of the first cervical vertebra showed asymmetry and inequality of size on the two sides. There was a rounded defect in the occiput adjacent to the foramen magnum on the right. There was congenital basilar impression (platybasia). The cervical spine showed marked hyperextension. There were multiple spondylolistheses in the upper cervical region. Clinical diagnoses of Klippel-Feil syndrome, syringomyelia and latent lues were made. A series of roentgen treatments was administered to the cervical and dorsal areas. There was no improvement and the patient was discharged from the hospital on September 23, 1939.

He re-entered the hospital one year later, complaining of vertigo and weakness of the right arm and leg. Physical examination showed a slight dorsal kyphoscoliosis and marked limitation of all movements of the neck. Atrophy of the right pectoral, supraspinatous, and infraspinatous muscles was still present. There was an area of anesthesia extending from the left inguinal region to the level of the knee which had not been present previously. There was diminution of the vibration sense in both lower extremities and the pelvic region to the level of the anterior superior iliac spines. There was glove type anesthesia extending to the junction of the middle and lower thirds of the forearm on the right. Astereognosis of the right hand was present. Roentgen study of the cervical spine showed no changes since the previous observations. Attempts to relieve the symptoms with head traction were unavailing and he returned home on October 23, 1940.

Fig. 1*C*. Case 1. Roentgenogram of the skull, occipital projection (Towne position). There is coarctation of the foramen magnum. The arch of the first cervical vertebra is asymmetrical and not uniform in size. The odontoid process is tilted to the right. There is a congenital defect in the occiput on the right side in the region adjacent to the foramen magnum.

Fig. 1*B*. Case 1. Roentgenogram of the cervical spine, lateral projection. There are multiple congenital anomalies and coalescence of the first, second, third, fourth, and fifth cervical vertebrae. The cervical lordosis is markedly increased. There is platybasia, the odontoid process rising to a higher level than normally and elements of the cervical spine lying above Chamberlain's line, consistent with congenital basilar impression.

Case II. D.M. (No. 921069), a five year old white boy, was considered normal until 1948 when his mother noticed that the right supraspinatous region and shoulder were more prominent than the left. She was not greatly alarmed as his father had a short, broad neck. Two

FIG. 2*A*. Case II. Photographs, front and rear views. The neck is short and broad. The right shoulder is elevated and the right scapula markedly prominent. The nuchal hair line is low.

years later, he entered the hospital as the elevation and prominence of the right shoulder appeared to have become more marked. The child was asymptomatic. There were no congenital defects in the 4 siblings.

FIG. 2*B*. Case II. Roentgenogram, anteroposterior projection. There are multiple congenital anomalies with vertebral malformations and spina bifida in the cervical and upper dorsal region. There is a marked degree of scoliosis to the right in the cervicodorsal region.

Physical examination disclosed a short, broad neck with low hair line. The movements of the neck were normal in the anteroposterior directions; lateral motions were limited to 20 degrees from the midline on the right and 30 degrees on the left. The right scapula was high and prominent. The right supraclavicular and infraclavicular regions showed distinct fullness. He appeared normal mentally.

Roentgen study revealed (Fig. 2*B*, 2*C*, and 2*D*) coalescence of the first and second cervical vertebrae with multiple defects and spina bifida in the cervical and upper dorsal spine. There was scoliosis to the right in the cervicodorsal region and markedly increased cervical lordosis. Hemivertebrae were present in the cervical and dorsal portions of the spine and the number of ribs was unequal on the two sides. The chest was asymmetrical and the upper ribs were narrowed, distorted and in close approximation to each other.

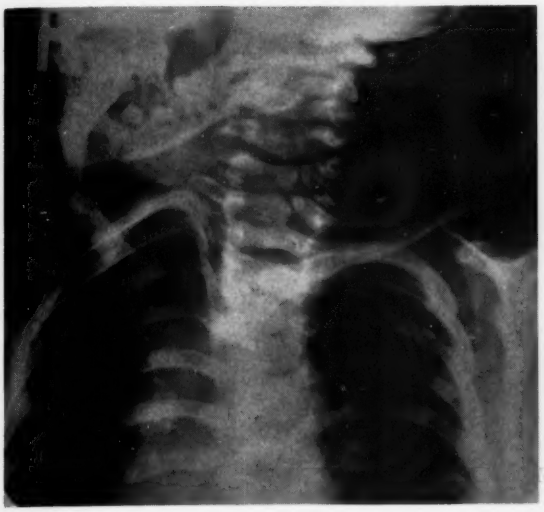

Fig. 2*C*. Case II. Roentgenogram, oblique projection. The anomalies in the cervicodorsal spine are more clearly visualized than in the anteroposterior projection.

Fig. 2*D*. Case II. Roentgenogram, lateral view. There is coalescence of the first and second cervical vertebrae. The cervical vertebrae show multiple congenital defects. There is marked increase in the cervical lordosis.

Case III. L.M. (No. 706510), an eight year old school girl, was referred to the hospital because of "poor posture." Frequent admonition by her parents to keep her head erect had been unavailing. She gave a history of having been a "wheezing baby" with frequent attacks of respiratory distress which were relieved by changes in position.

Physical examination disclosed a short, broad neck with wide flaring of the trapezius muscles. The head projected anteriorly from the shoulders and could not be brought to the normal erect position. Lateral movements were limited. The hair line extended to the upper

Fig. 3*A*. Case III. Photographs, front, back, and side views. The neck is markedly foreshortened. The head is tilted and thrust forward. The left shoulder is prominent and the left side of the chest is asymmetrical with malposition of the left nipple. The left scapula is markedly prominent.

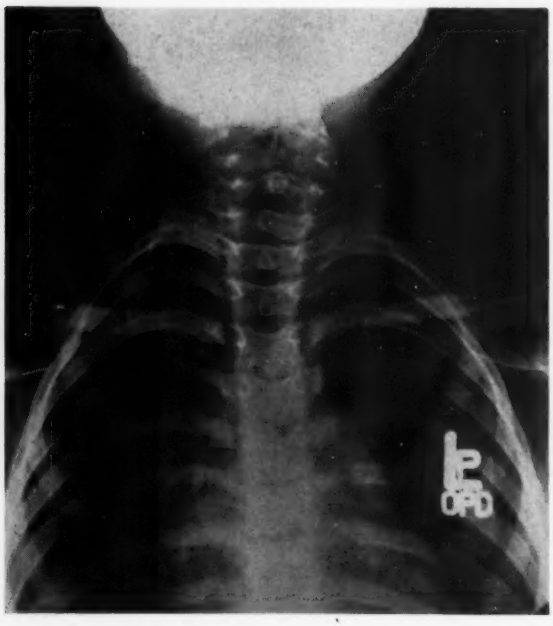

FIG. 3*B*. Case III. Roentgenogram, anteroposterior projection. The sixth cervical vertebra shows spina bifida. There is slight scoliosis to the right in the cervicodorsal region.

FIG. 3*C*. Case III. Roentgenogram, lateral view of cervical spine. The first cervical vertebra is elongated and tilted. The second to sixth cervical vertebrae are anomalous and fused. The normal cervical lordosis is completely absent.

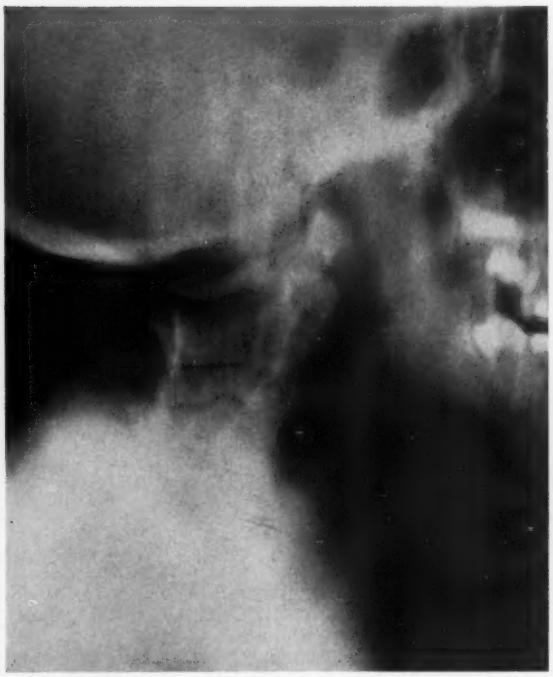

FIG. 3*D*. Case III. Laminagram, lateral projection, cervical region. The coalescence of the cervical vertebrae is well illustrated.

FIG. 3*E*. Case III. Lumbosacral spine, anteroposterior view, showing spina bifida of the fifth lumbar vertebra.

portion of the thorax. No other anomalies were present. She was mentally alert and her progress at school was good.

Roentgen examination revealed coalescence of the second to sixth cervical vertebrae, absence of the normal cervical lordosis, and tilting and elongation of the first cervical vertebra. Laminagrams were helpful in visualizing the extent of the defects. Studies of the lumbosacral spine showed spondylolisthesis in the lumbosacral region with a congenital defect involving the posterior aspect of the fifth lumbar vertebra in the region of the junction of the inferior articular process and the lamina.

Case iv. J.G. (No. 809656), a four year old white female, was admitted to the hospital on September 3, 1946, with the diagnosis of "wry neck." At birth her parents had noted a tilt of her head to the right and a soft fluctuant mass just below the occiput. This mass was operated on at the age of five months and proved to be a meningocele. It was repaired and the posterior wall reinforced. The torticollis persisted until the second admission.

Fig. 3*F*. Case iii. Lateral roentgenogram, lumbosacral spine. There is spondylolisthesis with anterior displacement of the fifth lumbar vertebra in relation to the sacrum and a congenital defect in the posterior aspect of the fifth lumbar vertebra.

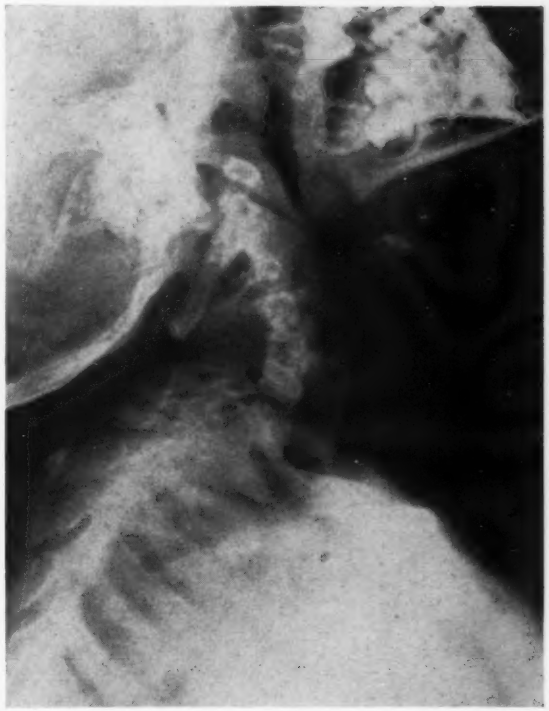

Fig. 4 Case iv. The cervical vertebrae are deficient in number, fused, and anomalous in structure. The spinous processes are deficient.

Physical examination of the child was normal other than for a tilt of the head to the right and limitation of movements of the head and neck. The right sternomastoid muscle was thickened and fibrotic.

Roentgen studies showed coalescence of the cervical vertebrae with anomalies of the vertebral bodies. The spinous processes were malformed and deficient in size and density.

Case v. M.W. (No. 1320456), a thirty-four year old white female, was admitted to the hospital in active labor. On admission, physical examination was not remarkable except that the patient was very short and stocky. A healthy normal baby girl was delivered without unusual difficulty. Two days later, roentgen examination of the chest and neck of the mother was requested because of shortness of breath, hoarseness and cough.

Roentgen examination revealed coalescence of the second and third cervical vertebrae. The dens was small and poorly formed. The second cervical vertebra showed anterior displacement with relation to the axis. The spinous

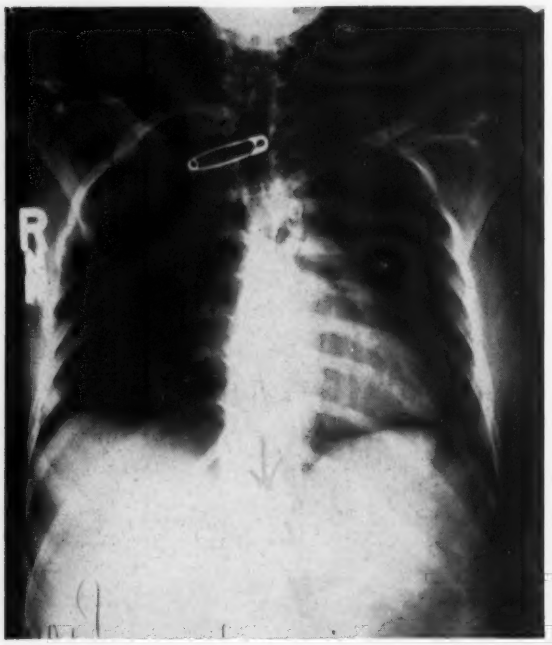

FIG. 5*A*. Case v. Anteroposterior roentgenogram. There is a marked degree of scoliosis to the left. There is a congenital anomaly with a hemivertebra in the upper dorsal region.

processes of the second to fifth vertebrae were broad, short and partially bifid. There was scoliosis to the left in the cervicodorsal region

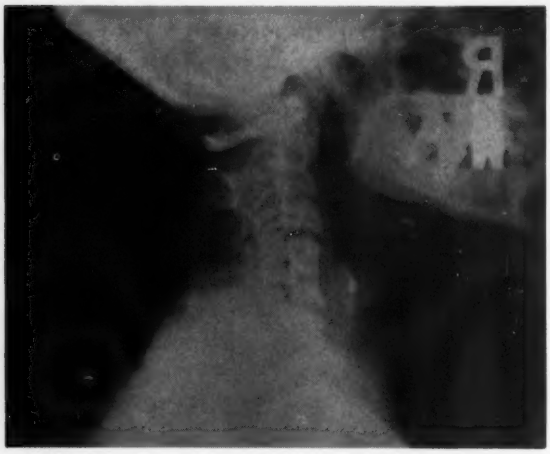

FIG. 5*B*. Case v. Lateral view. The dens is small and poorly formed. There are fusions of the second and third and also of the fifth and sixth cervical vertebrae. There is spondylolisthesis at the level of the first and second cervical vertebrae. The spinous processes of the upper and mid-cervical vertebrae are broad. There is absence of the cervical lordosis.

with a hemivertebra on the left side between the fifth and sixth dorsal vertebrae.

CASE VI. J.R., a newborn infant girl, was noted to have an unusually short neck. The nuchal hair line extended to the superior margin of the thorax. The motions of the neck appeared limited. The baby seemed normal otherwise and there were no changes in the reflexes. Roentgen examination revealed decrease in the number of the cervical vertebrae

FIG. 6*A*. Case VI. Anteroposterior view. The cervical vertebrae are anomalous and show extensive spina bifida. The neural arches and spinous processes are deficient.

and extensive spina bifida in the cervical region. The neural arches and spinous processes appeared absent. There was marked shortening of the neck.

There are no previously reported cases of fractured cervical vertebrae associated with the Klippel-Feil syndrome, hence the following 2 cases are of particular interest.

CASE VII. A.G. (No. 38833), a twenty-eight year old male, was considered well until seventeen years of age when he complained of intermittent paresthesias of the back of the head, the neck, and the inferior aspect of the chin. Exposure of the neck to a strong gust of wind elicited painful tingling sensations. He had

frequently noted sudden unexplained weakness of both arms while swimming or playing football. This was relieved spontaneously by a few minutes' rest. When twenty-eight years old he was struck in the back of the head by a falling plank and was thrown to the ground but did not lose consciousness.

On admission to the hospital, he complained of pain and tingling in the region of the chest, the forearms, and the hands. Palpation of the neck caused pain in the region of the mid-cervical vertebrae. There was pronounced weakness of the upper extremities and generalized hypesthesia of the upper arms and forearms. The knee jerks and abdominal reflexes were

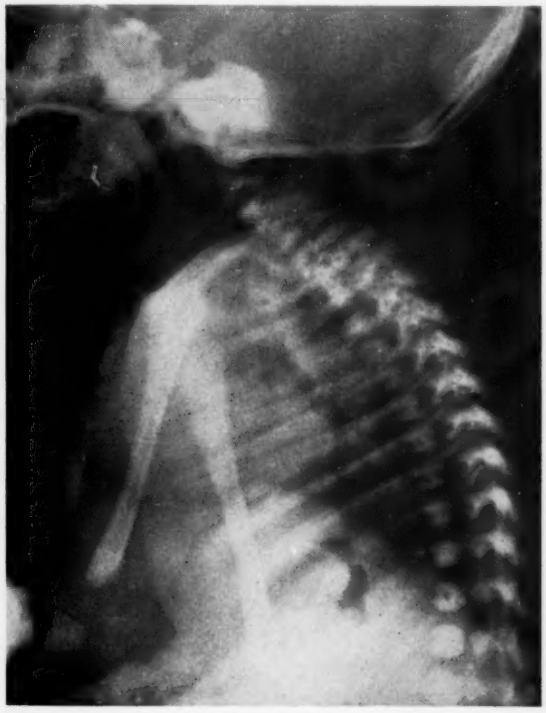

Fig. 6*B*. Case vi. Lateral view. There is diminution of the number of cervical vertebrae with defective ossification and multiple malformations. The decrease in the length of the neck is very striking.

hyperactive. The Babinski reflex was equivocal on both sides. He had to be catheterized the day following admission because of distention of the bladder. Cystometrograms showed an atonic bladder and tidal drainage was instituted.

Roentgen examination disclosed fusion of the second and third cervical vertebrae. Halter type traction was applied to the head and neck.

Fig. 7*A*. Case vii. Anteroposterior roentgenogram. The dens is short and the body of the second cervical vertebra is asymmetrical. The fusion of the second and third cervical vertebrae is obscured by the shadow of the inferior teeth and the mandible.

Fig. 7*B*. Case vii. Laminagram, anteroposterior view. The coalescence of the second and the third cervical vertebrae is well illustrated.

FIG. 7*C*. Case VII. Lateral roentgenogram. The second and the third cervical vertebrae are fused, the intervertebral space between these vertebrae being practically completely obliterated. The cervical lordosis is diminished. The spinous process of the axis is broad and bifid.

After four days, the paresthesia of the chest wall disappeared. An uninhibited reflex cord bladder was found to be present. Tidal drainage was discontinued. Motor power of the upper extremities returned to normal on the tenth day. On the thirty-third day a rigid supporting collar of plastic material was applied to the cervical spine in full extention and the patient was permitted to get out of bed. At the time of discharge on the thirty-ninth day, neurological tests were normal except for weakness of the left lower extremity which manifested itself by a slight limp.

Roentgen studies were carried out ten years following discharge and disclosed coalescence of the second and third cervical vertebrae with practically complete obliteration of the intervertebral space between these vertebrae. The dens was short and blunted. The body of the axis was asymmetrical, with tilting of the axis, producing a scoliosis in the upper cervical region. The cervical lordosis was diminished. Laminagraphy revealed the changes more clearly than the conventional roentgenograms and proved of definite aid in the demonstration of the anomalies.

CASE VIII. (This case is reported through the courtesy of Dr. Clarence E. Cook, medical examiner of Edmonton, Canada.) A.B., male, a thirty year old white clerk, was travelling in the observation car of a train at Jaspar, Alberta. The train unexpectedly slowed down to 5 to 10 miles per hour. The patient leaned over the railing to ascertain the cause of the delay and accidentally fell out of the car, landing on his back on the ground. Witnesses were surprised on reaching his side to find that he was dead.

Dr. Cook performed the postmortem study. Physical examination showed the patient to be short and stocky with marked shortening of the neck. The hair line extended to the superior margin of the thorax. Examination of the base of the skull revealed a fracture of the foramen magnum and also fractures of the dens and the atlas (slightly below the level of the foramen magnum.) The adjacent portion of the spinal cord was contused and lacerated. The third, fourth and fifth cervical vertebrae were united into a rigid column of bone. The sixth cervical vertebra was divided into two parts, the left half being in the form of a hemivertebra

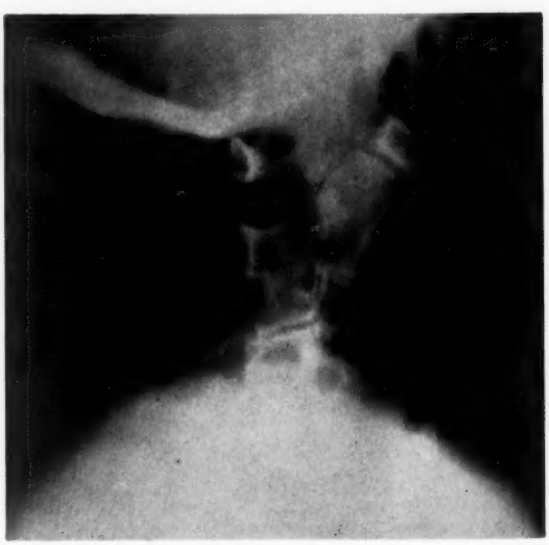

FIG. 7*D*. Case VII. Laminagram, lateral projection. The shortening and flattening of the dens and the coalescence of the second and third cervical vertebrae are more clearly visualized than in the conventional roentgenogram.

which was fused to the seventh cervical vertebra. The right segment was also a hemivertebra and had normal facets and articulations. Dr. Cook was of the opinion that the fused vertebrae had acted as a lever with the fulcrum to the left of the atlas and foramen magnum and that the bony coalescence had limited the lateral mobility of the cervical spine to such an extent that a relatively slight trauma had caused the fatal fracture.

DISCUSSION

The term "Klippel-Feil syndrome" is used to denote a condition characterized by specific anomalies of the cervical vertebrae. The lesion comprises primarily a fusion of two or more cervical vertebrae and manifests itself clinically by a shortening and limitation of mobility of the neck. In association with the malformations in the cervical region, there are in many intances anomalies of other segments of the spine, congenital abnormalities of other portions of the skeleton and neurological disturbances. If the vertebral coalescence is slight in degree and other associated spinal anomalies are absent, the condition may produce no clinical manifestations and go unrecognized unless roentgen studies are performed.

In the more marked cases, the patient presents a characteristic clinical picture and the diagnosis can often be established definitely by inspection alone. The neck is markedly foreshortened or entirely absent. The head is sunken and implanted on the chest. The hair line posteriorly is very low, extending to the upper limit of the thorax. The head is, in many instances, maintained in a position of torticollis. Other less common manifestations comprise facial asymmetry, mirror movements, difficulty in breathing and swallowing, and shortness of breath. The movements of the head are usually limited although there is freedom from pain on motion. Meningocele in the cervicodorsal region rarely accompanies the syndrome. Syringomyelia, radiculitis of the cervical roots due to constriction and narrowing of the foramina, platybasia, and defects in the foramen magnum, such as coarctation and asymmetry, are rare concomitants of the syndrome.

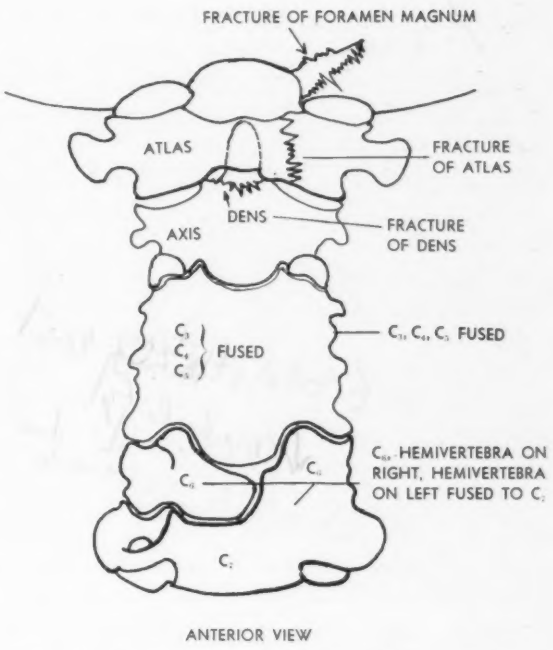

Fig. 8. Case VIII. Schematic diagram, anterior view, of cervical vertebrae as found at postmortem examination. There are fractures of the foramen magnum, atlas, and dens. The third, fourth, and fifth cervical vertebrae are fused. The sixth cervical vertebra is in the form of two hemivertebrae, that on the left being fused to the seventh cervical vertebra.

The etiology and pathogenesis of the Klippel-Feil syndrome are still subject to conjecture and controversy. Each vertebra is normally formed from cells derived from two adjacent pairs of mesodermal somites. There is no adequate explanation for abnormal migration or development of these cells. Ingalls has artificially induced specific orthopedic defects in animals in the early days of pregnancy but no vertebral fusions have developed. Although there have been several instances of the Klippel-Feil syndrome in the same family, no mendelian pattern has been demonstrated.

Our patients illustrate well the wide variation in the clinical manifestations. The first case exemplifies the severe form of the syndrome with the characteristic short, broad neck, neurological symptoms referable to the cervical portion of the spinal

cord, and subsequent atrophy of the right half of the body. In the second case, the associated anomalies of cervical and dorsal hemivertebrae, unequal numbers of ribs on the two sides, and elevated scapula are of importance. The third patient was unable to bring her neck to an erect position due to the coalescence of the cervical vertebrae. The fourth case is unusual because of an associated meningocele. One case (Case v) is noteworthy as the patient appeared outwardly normal despite the multiple spinal deformities revealed on roentgen examination. The seventh patient suffered from vague hyperesthesias in the region of the back of the head, neck, and chin for ten years before roentgenograms of the cervical spine were taken after an acute neck injury and established the diagnosis. Two of our patients suffered from fractures adjacent to the fused portion of the cervical spine. With diminished mobility of the head and neck, the vertebra directly adjacent to the fused column of bone is more liable to fracture than a normal vertebra.

No therapy is apparently effective in altering the course of this syndrome. Traction, remedial exercises, and manipulation may be utilized for symptomatic relief.

It is important to distinguish these congenital fusions of the cervical spine from tuberculosis of the spine, congenital torticollis, old healed fractures and other similar conditions in which therapy offers hope of improvement or alleviation of symptoms. It is in most instances not advisable to utilize extensive or formidable modes of therapy, efforts being confined to symptomatic and supportive measures. It is important to bear in mind that individuals with the Klippel-Feil syndrome are particularly prone to fractures of the cervical spine because of the limited or absent mobility of the neck and they should therefore refrain from diving and arduous sports such as wrestling or football in which there is violent bodily contact. Traumatism to the head or neck should be avoided. The prognosis is good and as a rule the condition is compatible with a long life. The associated muscular and orthopedic deformities or the combined congenital and neurological lesions may alter the prognosis and require special forms of therapy.

The roentgen examination is essential to establish the diagnosis and to determine the character and extent of the malformations in the cervical spine as well as other skeletal anomalies. Two or more of the central vertebral masses are solidly united into a single bony mass with complete absence of the intervertebral spaces and discs. The lateral masses are irregular or fused and the spinous processes small, deficient or bifid. The intervertebral foramina are smooth in contour but are frequently smaller than normal and oval rather than circular in shape. Fusion of the altas and occiput is common. Anomalies of the more caudal portions of the spine comprising anterior and posterior spina bifida, sacralization of the last lumbar vertebra, and hemivertebrae may be found. Scoliosis and kyphosis are occasionallly present. Roentgen studies of the skull should always be performed in order to demonstrate associated deformities such as platybasia and coarctation, asymmetry and other malformations of the foramen magnum. Sprengel's deformity, or congenital elevation of the scapula, and cervical ribs are often present, the extent of these changes varying considerably on the two sides. There is elevation of the apices of the lungs.

The technical aspects of the roentgen examination are of the greatest importance to demonstrate the character and extent of the changes. Because of the short neck and sunken head, roentgenograms of perfect detail may be obtained only with considerable difficulty. This is particularly true of the anteroposterior and oblique projections, as the occiput and mandible overlie and obscure the cervical vertebrae. Roentgenograms with the jaw in rapid motion may be helpful in making the anteroposterior films. Laminagraphy may be essential in cases with extensive coalescence

of the cervical vertebrae. In infants and young children laminagrams are unsatisfactory due to lack of contrast. Stereoscopic roentgenograms are essential and should be utilized in every instance. The roentgen studies should include not only the cervical region but also the remainder of the spine, the skull, and other parts of the body as indicated.

The Klippel-Feil syndrome was in the past considered a rare and unusual condition. The 8 cases discovered by us indicate that it is much more common than previously supposed and must be considered in the differential diagnosis of all malformations of the upper spine. With the greatly increased application of roentgen methods of examination in present-day practice, many new cases will be found and recorded and the syndrome will take its rightful place in clinical practice as a relatively frequent lesion.

SUMMARY

The Klippel-Feil syndrome is characterized by fusion of two or more vertebrae in the cervical region and is manifested by shortening and limitation of mobility of the neck, lowering of the nuchal hair line and, when severe, by implantation of the head on the chest. In marked cases, inspection suffices to establish the diagnosis. Neurological manifestations of varying types are of frequent occurrence.

The etiology is unknown. There is a disorder of the mesodermal and ectodermal tissues and the deformities apparently commence during the third to the eighth week of development of the fetus.

The disease is compatible with long life, although associated congenital anomalies, which are of frequent occurrence, result in an altered prognosis.

The patient with the Klippel-Feil syndrome is particularly susceptible to fracture of the cervical vertebrae with relatively slight trauma due to the limited or absent mobility of the neck and must avoid violent exercise and traumatisms to the head and neck.

The diagnosis can be established definitely only by roentgen studies. With the increased application of roentgen methods of examination in modern medical practice, the condition will be found to be much more common than was previously supposed.

We have recorded eight additional cases, three of which were studied by laminagraphy in addition to the usual methods of roentgen examination.

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THE ROENTGEN DIAGNOSIS OF DEXTROPOSITION OF THE AORTA*

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THE dextroposed or overriding aorta is present as a part of the complex in several cyanotic congenital cardiac syndromes. The various signs used to interpret these syndromes from the roentgenograms usually do not indicate specifically whether the aorta is dextroposed. In certain cases, this may be suspected if the relationship of the aorta to the right ventricle is examined. An analysis of this relationship is presented, primarily as seen in the tetralogy of Fallot.

The following roentgen criteria are usually expected in cases of the tetralogy of Fallot:

(1) In the posteroanterior projection:
  (a) A relatively small heart with an elevated apex.
  (b) A concave pulmonary artery segment.
  (c) Prominent ascending aorta and arch. A right aortic arch in 20–25 per cent of the cases.
  (d) Small pulmonary artery branches and radiolucent lung fields. Vessels of small caliber at times replace the "hilar commas."

(2) In the left anterior oblique projection:
  (a) Right ventricular enlargement as indicated by a forward protrusion of the cardiac silhouette relative to the root of the aorta.
  (b) Elevated cardiac apex producing what has been called the "apple on a stem" appearance.
  (c) A clear pulmonary window.
  (d) No left ventricular enlargement unless the patient is in failure.

(3) In the right anterior oblique projection:
  (a) A concave pulmonary artery segment.
  (b) Right ventricular enlargement as evidenced by a fullness of the anterior cardiac silhouette and a decreased retrosternal space.
  (c) No left auricular enlargement.
  (d) Rarely, an indentation of the posterior wall of the barium filled midthoracic esophagus by enlarged bronchial arteries.

The frequency with which these criteria are seen varies somewhat; the extreme cases include those in which almost all of the above signs are present, while in others the contours of the heart may approach normal.

The question of dextroposition of the aorta is not answered by these criteria. In some cases, the relationship of the ascending aorta to the right ventricle in the left anterior oblique projection is such that one can offer an affirmative answer to this question. The following conditions are required to support this diagnosis:

(1) The patient must be cyanotic or present some degree of arterial blood oxygen unsaturation.

(2) In the left anterior oblique view there must be no appreciable anterior projection of an enlarged right ventricle relative to the root of the aorta. This part of the cardiac silhouette is comparatively flat and the notch at this junction may be lost. As a result, this border approaches the normal configuration, and may show no evidence of right ventricular enlargement even when this chamber is grossly enlarged (Fig. 1).

(3) Right ventricular enlargement must be demonstrable in the right anterior oblique projection in order that the above findings can be differentiated from the normal.

(4) In the left anterior oblique projection the retrosternal space is decreased, due to the anteriorly placed aorta and enlarged right ventricle.

(5) In the left anterior oblique view the ascending aorta arises from a relative

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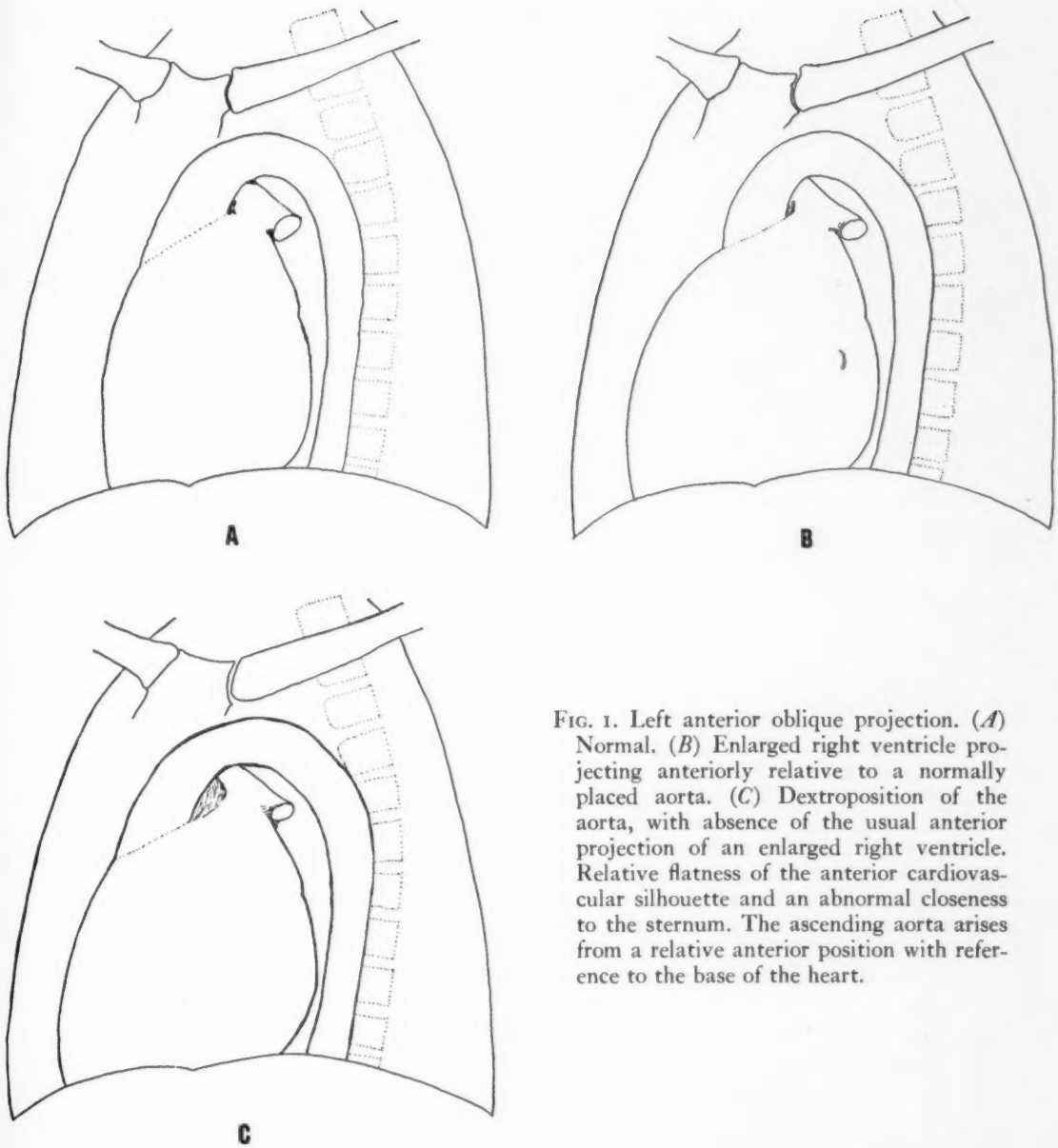

Fig. 1. Left anterior oblique projection. (*A*) Normal. (*B*) Enlarged right ventricle projecting anteriorly relative to a normally placed aorta. (*C*) Dextroposition of the aorta, with absence of the usual anterior projection of an enlarged right ventricle. Relative flatness of the anterior cardiovascular silhouette and an abnormal closeness to the sternum. The ascending aorta arises from a relative anterior position with reference to the base of the heart.

anterior position with reference to the base of the heart. As a result, the major position of the cardiac mass is projected posterior to a line dropped vertically from the root of the aorta.

(6) The anterior margin of the ascending aorta must be identifiable with certainty in the left anterior oblique projection.

This last criterion may seem unnecessary, but not infrequently this portion of the aorta is hidden by the thymus or simulated by the axillary folds, particularly in the infant. This is usually avoidable if the left anterior oblique view is exposed at or near a 60 degree angle of rotation, with the back kept straight, the neck extended, and the exposure made in full inspiration. Assuming that the aortic border is visible in a cyanotic patient, the failure to demonstrate bulging of an enlarged right ventricle anterior to its root constitutes sufficient evidence to suggest a dextroposed aorta. This is substantiated by finding the ascending aorta arising from a relatively

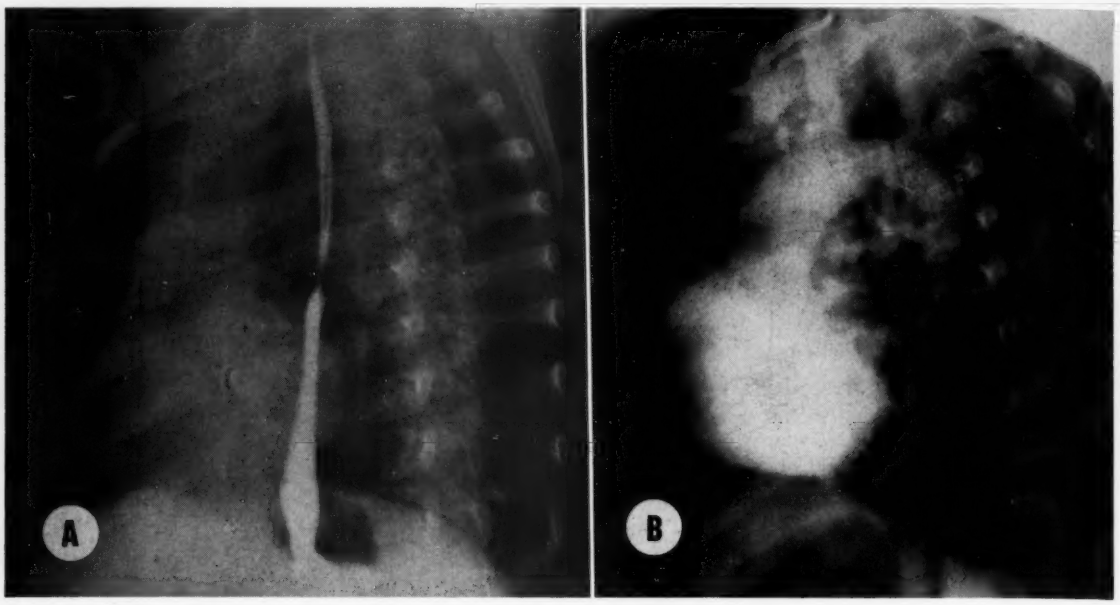

FIG. 2. Tetralogy of Fallot. (*A*) Left anterior oblique view demonstrating the anteriorly placed aorta with the resulting flatness of the anterior cardiovascular silhouette and prominent posterior cardiac mass. (*B*) Angiocardiogram, two and a half seconds after injection. Opacification of the superior vena cava, right auricle, enlarged right ventricle, infundibular stenosis, pulmonary artery, and of the dextroposed, anteriorly placed aorta without filling of the left auricle or ventricle.

anterior position with reference to the base of the heart. The closeness of the right ventricle and aorta to the sternum in the left anterior oblique view is helpful, but somewhat more difficult to evaluate (Fig. 2 and 3).

A corollary in cases showing the above findings explains the occasional failure to demonstrate even appreciable right ventricular enlargement in the left anterior oblique view. A projection anterior to the root of the aorta is considered evidence of right ventricular enlargement. The dextroposed aorta disturbs this relationship, and in these cases, the enlargement is partly or completely obscured. In addition, the relatively large cardiac mass posterior to the vertical plane of the ascending aorta may suggest a spurious left ventricular enlargement.

The use of these criteria over the past two years has been helpful. No single roentgenological sign will stand alone in the interpretation of the roentgenograms of congenital cardiac lesions. The various signs present, when added together, must point in the the same direction. This is similarly true of the signs indicating a dextroposed aorta. Absence of the signs of a dextroposed aorta does not exclude this malformation.

Experience to date has demonstrated that errors in interpretation may occur when the ascending aorta is not clearly demonstrable or when its borders are delineated only with the aid of imagination or interpolation. A second source of error is found when an attempt is made to diagnose an overriding aorta with minimal or no definite evidence of right ventricular enlargement. A third possible error occurs when there is a right aortic arch, since the usual relationship of the projected shadows of the aorta and the right ventricle is disturbed, making interpretation more difficult. A false positive diagnosis of an overriding aorta might be postulated in tricuspid atresia with a non-functioning right ventricle, since the anterior cardiovascular silhouette in the left anterior oblique view is straight. However, there is no right ventricular enlargement in the other views,

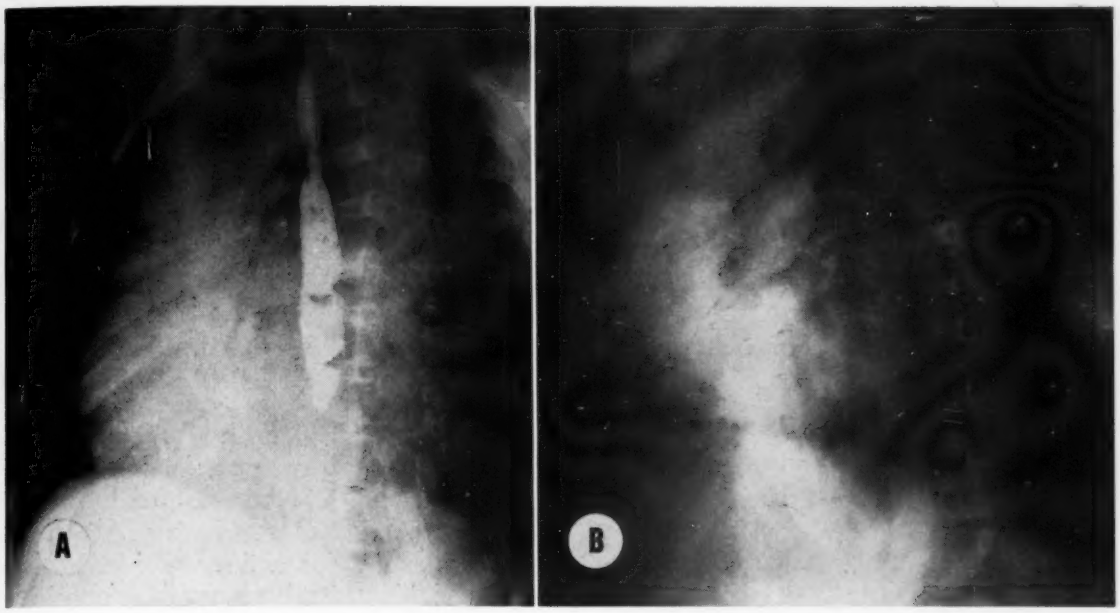

Fig. 3. Tetralogy of Fallot. Left anterior oblique projection. (*A*) As in Figure 2*A*. (*B*) Angiocardiogram two seconds after injection. Opacification of the right auricle, enlarged right ventricle, infundibular stenosis, pulmonary artery, interventricular septal defect with some staining of the left ventricle, and heavy opacification of the dextroposed aorta without significant filling of the left heart.

the ascending aorta and heart are not close to the sternum in the left anterior oblique projection, and there is an enlarged left auricle, which effectively prevents an error of interpretation in this syndrome. Another limitation occurs when there is appreciable enlargement of the pulmonary artery or right auricular appendage. They obscure

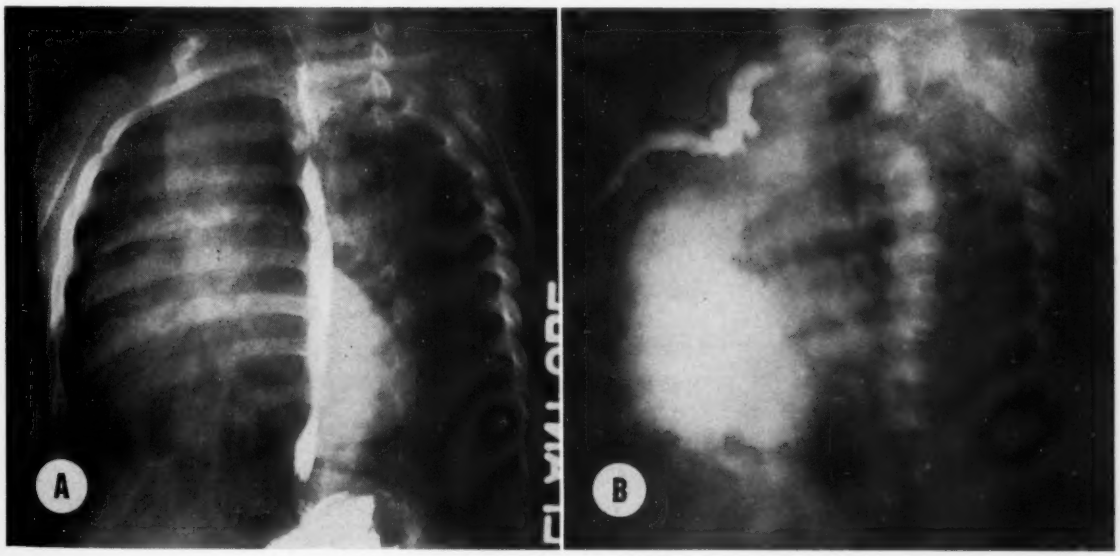

Fig. 4. Transposition of the great vessels. Left anterior oblique projection. (*A*) Aorta placed far anteriorly. (*B*) Angiocardiogram three seconds after injection. Visualization of the right auricle and ventricle, anteriorly placed transposed aorta, some staining of the left auricle, and no opacification of the left ventricle or pulmonary artery.

FIG. 5. Eisenmenger complex. Left anterior oblique projection. Aorta placed well forward without an anterior projection or bulging of the enlarged right ventricle. Decreased retrosternal space. The major portion of the cardiac mass is projected posterior to the vertical plane of the ascending aorta.

the junction of the aorta and right ventricle, and hence the possibility of a dextroposed aorta cannot be ascertained.

In a review of 32 cases of the tetralogy of Fallot (verified by autopsy, surgical exploration, or angiocardiography) at this institution, a diagnosis of dextroposed aorta based on these criteria could be made in over 85 per cent. A number of other cases were discarded because of inadequate roentgenograms. It must be acknowledged that it is easy to see any diagnosis or sign when examining known and proved cases. Nevertheless, its use in new and unknown cases has been most gratifying.

Dextroposition of the aorta occurs also in the Eisenmenger complex, the Taussig-Bing syndrome, and the variants of the tetralogy of Fallot such as "pseudo" truncus arteriosus. In these syndromes a dextroposed aorta may be suspected from the roentgenogram, if the same criteria are applied. In transposition of the great vessels the aorta arises completely from the right ventricle and originates from the most anterior portion of the base of the heart in the left anterior oblique projection. Because of this, the criteria for dextroposition of the aorta are exaggerated, and the picture is most striking (Fig. 4 and 5).

SUMMARY

The roentgen diagnosis of dextroposition of the aorta may be made in some cases of cyanotic congenital heart disease if in the left anterior oblique roentgenogram there is:

(1) No anterior bulging of an enlarged right ventricle relative to the root of the aorta.
(2) A decreased retrosternal space due to the anteriorly placed aorta.
(3) The root of the aorta originates from a relatively anterior position with respect to the base of the heart.

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RETROPERITONEAL PNEUMOGRAPHY BY INJECTION OF OXYGEN INTO THE PRESACRAL SPACE

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GOOD results have been reported with visualization of the kidneys by injecting air in the perirenal spaces,[1] but most roentgenologists and urologists are hesitant about using the latter method because of the danger of embolism in this highly vascularized area. A technique which obviates this danger by injecting oxygen into the presacral area instead of the perirenal region was described by Ruiz Rivas[6] in 1948 and by Juri[4] in 1949. The procedure requires no premedication and may be carried out in about fifteen minutes. The patient experiences practically no discomfort and walks out of the examining room to resume his normal activities. Only one puncture is required for visualization of both kidneys, and other abdominal organs stand out prominently, such as the spleen, liver, the female reproductive organs, and often the gallbladder and the intestines. The use of oxygen is preferable to air since it is absorbed rapidly and causes no unpleasant aftereffects.

TECHNIQUE

With the patient in any position, but preferably the knee-chest, a spinal anesthesia needle is inserted at the level of the sacrococcygeal articulation, 1 cm. to the right or the left of the median line. It is directed upward, inward, and forward so that its point enters the presacral cellular tissue nearest to the anterior surface of the sacrum and in the median line. To make sure that the needle is in position (that is, in cellular tissue and not in a blood vessel) aspiration is carried out with a syringe; if no blood is obtained, a few centimeters of air are injected. If this air is injected easily, the needle is in proper position; if it does not enter easily and it is necessary to exert force, and if gas escapes through the needle, it may be concluded that the needle is in the presacral fibrous tissue; in that case, its position must be changed by advancing or withdrawing it, without a new puncture being necessary. The amount of gas to be injected can be estimated and confirmed by roentgenoscopic examination. After uniform distribution is obtained by changing the position of the patient, roentgenograms are secured for final study.

A slight modification of this technique is used by Juri,[4] of the National University of Cordoba. He has the patient place both hands on a low footstool near the roentgenographic table so that, although standing, he is virtually in the knee-chest position. Instead of using oxygen directly from an oxygen tank, he connects the tank with a football and connects the needle, after it has been inserted, with the football. By exerting pressure on the football, an assistant carefully controls the amount of oxygen to be injected. He locates the sacrococcygeal hiatus by finding with the right thumb the last sacral and first coccygeal vertebrae. He inserts the needle about a fingerbreadth to the right or left of the median line. The needle in position, he fills the syringe with 5 cc. of 1 per cent novocain, which he injects before proceeding further. His method of testing the position of the needle for injection of the oxygen is, like that of Ruiz Rivas, aspiration to see whether blood is obtained. The estimated amount of oxygen required is 300 cc. The criterion for stopping the injection is the patient's complaint of a feeling of heaviness in both lumbar regions.

The 2 following cases illustrate our application of the method.

FIG. 1. Case 1. Oxygen, indicated by the dark areas, surrounds the kidneys and outlines the retroperitoneal tissues. Arrows point to the outer border of the mass associated with the left iliopsoas.

CASE I. L. H., a three year old boy, was admitted to the Jewish Hospital* on July 10, 1950, because of anorexia and weight loss. Physical examination revealed a questionable mass in the left upper quadrant, a liver which was palpable 2 fingerbreadths below the right costal margin, and a palpable splenic tip. A moderate microcytic hypochromic anemia was found upon blood study.

Roentgen examination of the urinary tract disclosed the left kidney to be displaced laterally, but it was normal in size, contour, and position. The upper third of the left ureter was also displaced laterally by a mass placed medial to the kidney and containing mottled, small, calcified shadows.

A retroperitoneal oxygen injection was performed on July 18, 1950, and both kidneys, the iliopsoas muscles, and all the retroperitoneal structures were unusually well delineated (Fig. 1 and 2). The calcified mass displacing the left kidney was seen to be attached to the psoas muscle but separated from the kidney. Numerous diagnostic possibilities were considered in the inflammatory and neoplastic groups of disease entities.

Surgery was performed on July 25, 1950. A firm, irregular mass was removed from the substance of the left iliopsoas muscle. The histopathology was reported as sympathoblastoma (neuroblastoma).

FIG. 2. Case 1. An oblique projection reveals the mass to be separate from the left kidney (area within arrows) which is nicely outlined. The left adrenal is likewise well seen.

CASE II. H. E., a thirty-three year old man, was admitted to the Jewish Hospital on May 28, 1950, because of a slightly painful swelling in the right groin. The swelling developed six weeks prior to admission. Aside from mild generalized aches and pains in the lower extremities and a loss of 4 pounds in the preceding six weeks, there were no other complaints.

Physical examination was not contributory, except for the finding of a lymph node 2.5 cm. in diameter in the right groin. This was excised under local anesthesia on May 29, 1950. Microscopic examination of the pathological specimen revealed a ganglionic neurogenic sarcoma.

* Now the Albert Einstein Medical Center.

On July 7, 1950, the patient was subjected to perirenal oxygen insufflation according to the technique described above. Excellent visualization of all the retroperitoneal structures was

Fig. 3. Case II. This film reveals excellent visualization of all the retroperitoneal structures. Both kidneys and adrenals are well demonstrated. A study such as this in conjunction with excretory urography would be of great value in outlining the contours of the kidney parenchyma.

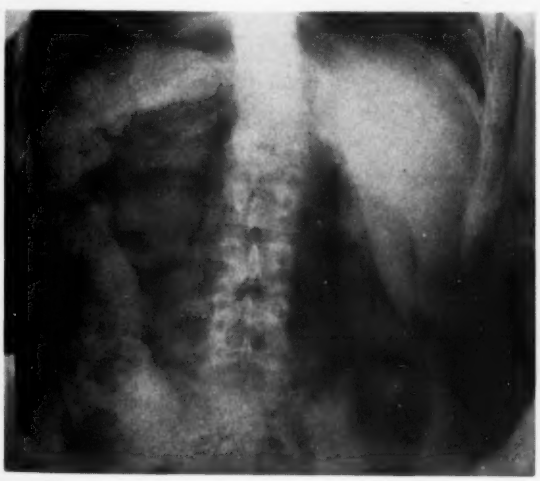

Fig. 4. Case II. A more detailed view of this case is seen. Note the clarity of the liver and splenic shadows in addition to the retroperitoneal structures.

Fig. 5. Case II. An oblique view discloses the left kidney shadow to be outlined with extreme clarity. Any lesion-producing distortion of the kidney contour could be clarified by this procedure.

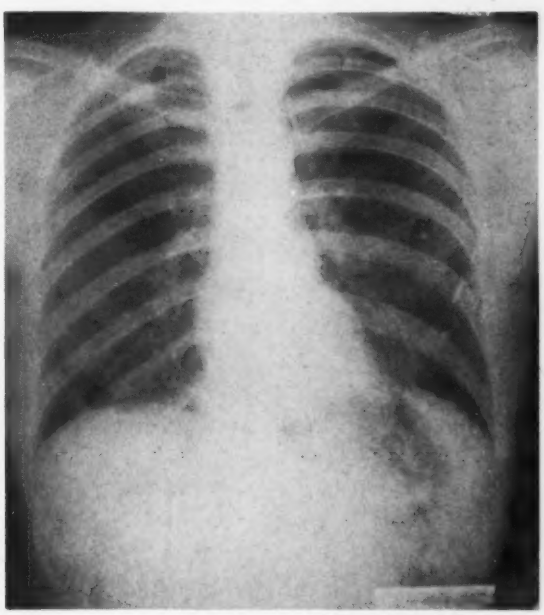

Fig. 6. Case II. This reveals the limitation of the gas by the diaphragm. In none of the cases injected by other workers did the gas ascend into the mediastinum. Here the gas has dissected along the diaphragmatic crura and lies under the diaphragmatic domes.

obtained, including the kidneys, adrenals, and iliopsoas muscles (Fig. 3–6). No tumors were seen, and thus the site of the primary lesion remains an enigma.

DISCUSSION

It is felt that this method has obvious advantages over those now in use for diagnosing adrenal neoplasm or retroperitoneal tumors. Certain renal tumors also may be visualized well by this method. Oxygen has been used as a contrast medium in various anatomical locations, usually with no harm if certain precautions are taken. Faulty technique and not the procedure is considered by Kleinberg[5] to be responsible for embolism following the introduction of oxygen into the knee for arthrography. In the discussion of Jacobsohn's[3] report of 2 deaths following the injection of air and oxygen, respectively, into the knee joint, it is pointed out that the method is safe, provided care is taken to avoid direct entry into a blood vessel. This precaution should also be observed in retroperitoneal pneumography.. Neither Ruiz Rivas[6] nor Juri[4] has had unfavorable results following visualization of the kidneys, and no untoward effects were observed in the 2 cases here reported. A further advantage is that no restrictions are necessary following the use of this method.

SUMMARY

Retroperitoneal pneumography is discussed in which good visualization of the kidneys was obtained by injecting oxygen into the retroperitoneal cellular tissue of the sacral region. The technique used was that described by Ruiz Rivas. Advantages of this method over currently used methods are pointed out.

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THE SIGNIFICANCE OF INTRA-ABDOMINAL CALCIFICATION IN THE NEWBORN INFANT*

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NEUHAUSER,[5] in 1944, called attention to the intra-abdominal calcifications frequently observed in association with fetal meconium peritonitis. Since his description, these findings have been confirmed by others and have come to be regarded as being pathognomonic of meconium peritonitis. Recently we observed a case which proved to be an exception.

A full term baby girl was born of a multiparous mother, following an uncomplicated pregnancy and uneventful labor. The infant demonstrated no unfavorable signs until the initial feeding at which time projectile vomiting occurred. All subsequent feedings were similarly vomited, and on the third day of life the infant was admitted to Children's Hospital. At that time the outstanding physical finding was moderate abdominal distention. Two loops of dilated bowel were easily visible and palpable in the upper abdomen. The lower abdomen was soft and flat. No peristaltic sounds were audible.

The anteroposterior film of the abdomen taken on the day of admission (Fig. 1) revealed two gas-filled portions of bowel considered to be stomach, duodenum, and the proximal jejunum. No gas was seen beyond the point of obstruction (upper jejunum), and the peritoneal reflection line was absent. In addition, there were numerous amorphous deposits of calcium about 1 mm. in size occupying the left side of the abdomen (Fig. 1) and extending from the twelfth rib to the iliac crest. These findings were interpreted as representing small intestinal obstruction (high jejunal) and fetal meconium peritonitis.

Lipiodol given by gavage tube outlined the above described loops as shown in the lateral view (Fig. 2). The lipiodol did not pass out of these loops at any time.

The infant was prepared for surgery, and an exploratory laparotomy was performed. Upon opening the abdomen, a greatly distended stomach, duodenum, and proximal jejunum were readily visible. The peritoneum was smooth and glistening, and no evidence of peritoneal calcification or previous peritonitis could be found. Further exploration revealed six separate atretic segments in the mid-jejuno-ileal region. These segments after resection measured 43 cm. in length, the longest segment being 13 cm. The operative procedure was completed by a side to side anastomosis of proximal jejunum and upper ileum.

Postoperatively, the baby continued to manifest signs of intestinal obstruction. An upright anteroposterior film at this time was identical with the admission film with one exception. The

FIG. 1. Note calcific deposits in left side of abdomen.

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FIG. 2. Lateral view showing distended loops outlined with lipiodol.

calcified deposits in the left side present on the initial examination were now absent on this and all subsequent films (Fig. 3). Despite two subsequent operations, obstructive signs persisted, and a satisfactory anastomosis was never achieved. At necropsy the stomach and duodenum were distended. A generalized fibrinous peritonitis was present. This was thought to be the result of a small leak which was evident at the site of anastomosis. No calcium deposits were found in the peritoneal cavity.

DISCUSSION

The relatively constant association of intra-abdominal calcification and fetal meconium peritonitis was first pointed out by Neuhauser.[5] He demonstrated that the deposits of calcium can occur in the bowel wall, bowel lumen, and peritoneal surface. In support of his conclusions, he presented complete studies of 3 newborn infants all of whom had roentgen evidence of calcification within the abdominal cavity. Intestinal atresia and meconium peritonitis of variable degree were demonstrated in all 3 infants, and the presence of peritoneal calcifications was confirmed microscopically. In one instance, complicated by an omphalocele, calcium deposits were found to be present in the intestinal lumen, bowel wall, and a small amount on the peritoneal surface.

O'Neill and his coworkers[6] were the first observers to suggest that intra-abdominal calcification was not always associated with meconium peritonitis. In their review of congenital intestinal atresia these authors included 2 cases of their own, both of which demonstrated calcified areas roentgenologically. We quote the concluding paragraph of their paper.

The nature and location of the opaque areas

FIG. 3. Postoperative upright view. Note absence of calcific deposits.

seen on the preoperative plain roentgenograms of both these patients are of great interest, in view of Neuhauser's opinion that such areas are typical of the presence of fetal meconium peritonitis. In the two infants here discussed, a diagnosis of meconium peritonitis could not be made with certainty, for even though the second patient had peritoneal adhesions present, no yellowish plaques of old meconium were present on the peritoneal surfaces. Furthermore, these calcified areas were not present on plain roentgenograms made four days after operation. It seems probable that in these two patients the calcified material was within the intestinal lumen, although this is not entirely certain.

The observations of O'Neill and his associates were recently confirmed by Camp and Roberts.[3] They described a newborn infant with stenosis of the terminal part of the ileum and very extensive intra-abdominal calcification. No evidence of intestinal perforation or fetal peritonitis could be demonstrated in this case. The deposits of calcium, as suggested by O'Neill and his associates[6] were shown to be contained within the intestinal contents.

Fig. 4. Roentgenogram of portions of the resected small intestine showing intraluminal calcium.

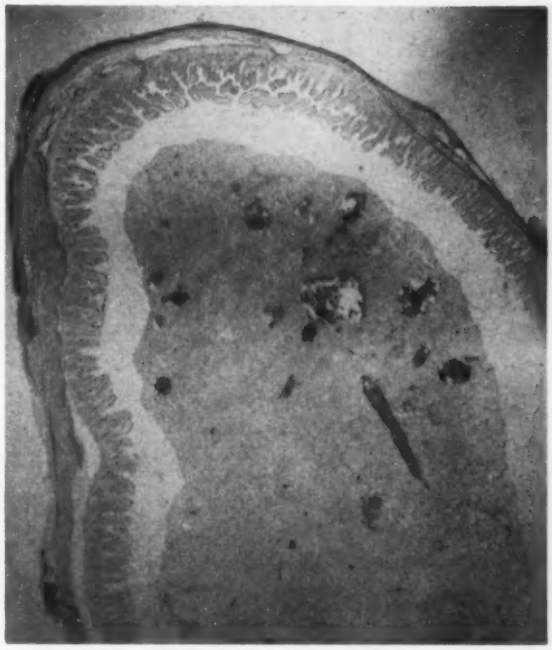

Fig. 5

Our own recent experience is similar to that of Camp and Roberts.[3] Although the roentgenogram was typical of meconium peritonitis in our case, no evidence of peritoneal calcification or peritonitis could be demonstrated at the time of operation. Roentgen studies following resection of the atretic segments revealed a complete absence of the calcified areas seen preoperatively. However, examination of the resected segments showed the presence of calcium deposits within the intestinal lumen. This was demonstrated by roentgen examination of the operative specimen (Fig. 4) and later confirmed microscopically. Sections of the atretic gut prepared with von Kossa's stain showed the calcium deposits to be confined to the lumen of the intestine (Fig. 5).

Meconium peritonitis is thought to occur from extrusion of meconium through an intestinal perforation which is usually located above a point of intestinal obstruction.[1,2,4] In a recent study of the pathogenesis of fibrocystic disease of the pan-

creas, Zuelzer and Newton[7] described a case of meconium ileus with special reference to the microscopic appearance of the atretic portion of bowel. We quote the following from their paper:

> Section through the atretic portion of the ileum showed a striking picture. Both muscle layers were well developed and formed complete rings around the central area corresponding to the submucosa, mucosa and lumen. This area was the seat of a typical meconium reaction, such as can be seen in the serosa of meconium peritonitis. It was composed of deposits of calcium, amorphous eosinophilic material and stringy mucus-like substance surrounded by numerous giant cells of foreign body type, fibroblasts, occasional hemosiderin-laden macrophages and at the periphery by fibrous connective tissue.

In the light of this observation it seems possible that even in proved cases of meconium peritonitis the calcification observed in the peritoneal cavity was originally laid down within the lumen of the intestine and was extruded subsequently through an intestinal perforation. Although a diagnosis of meconium peritonitis cannot always be made conclusively solely by roentgen studies, we feel it can be made correctly in most instances. In the majority of patients having meconium peritonitis, the calcium is seen as plaque formation on the surface of the liver or diaphragm and along the lateral peritoneal reflection lines. These plaques are usually associated with amorphous deposits more centrally located in the anteroposterior views and seen either anteriorly or posteriorly in the lateral view. Small or moderate amounts of amorphous calcium density should suggest intraluminal location. This is especially true if the calcium is arranged in linear fashion. This type of calcification is seen more centrally in the anteroposterior and lateral projections. Admittedly none of these criteria is absolute, but we believe they are helpful in arriving at the correct diagnosis preoperatively.

SUMMARY

The case of an infant demonstrating intra-abdominal calcification roentgenologically and suspected of having intestinal obstruction with meconium peritonitis is presented. Multiple intestinal atresia without peritoneal calcification or peritonitis was demonstrated at the time of operation. The calcified deposits were shown to be confined in the intestinal lumen of the atretic segments.

We wish to express our appreciation to Dr. Hans G. Schlumberger, Department of Pathology, Ohio State University College of Medicine, for his assistance in the preparation of the surgical specimens and for the photomicrograph.

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VOLVULUS OF THE CECUM*

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THE importance of volvulus of the cecum may be best appreciated by the estimate that approximately 1.5 per cent of all intestinal obstructions reported in this country are due to the existence of this condition. In some Scandinavian countries incidences of as high as 10 per cent are reported. The necessity of making an early diagnosis of cecal volvulus is emphasized by the very high mortality in unoperated cases, which reaches 100 per cent in some series. The value of early operations is attested in part by the declining rate of mortality which has come down from as high as 60 per cent to below 10 per cent.

The literature, which now numbers reports of over 400 cases from all over the world, was summarized by Wolfer, Beaton and Anson[4] in 1942. Since then additional reports have been chiefly concerned with a description of additional cases or some addition to the surgical technique. From the first report of a case by Rokitansky[3] in 1841 to the most recent publication of 12 cases by Dixon and Meyer[1] in 1948, almost every conceivable variation and type of volvulus involving the cecum, including sometimes the terminal ileum and /or the remainder of the right colon, has been described. Studies of the incidence of variations in the mobility and points of fixation of the cecum and the colon have been made by Wolfer and many others. Descriptions of diagnostic and therapeutic procedures have been remarkable for their lack of uniformity.

The roentgen diagnosis of volvulus of the cecum by means of plain films of the abdomen has not been discussed by most of the writers on the subject. However, McGraw, Kremen and Rigler[2] have listed six points which may be noted on plain films by which it may be possible to make the diagnosis. They are as follows:

1. Great distention of the cecum which will be ectopically located. (Frequently in the left upper quadrant.)
2. Distended small intestine located to the right of the cecum. (Secondary to rotation of the cecum.)
3. Visualization of the ileocecal valve on the right side of the cecum outlined by gas in the cecum.
4. The mucosal folds at the point of obstruction may be outlined by gas and assume a spiral contour.
5. Evidence of small intestinal obstruction.
6. Presence of a single fluid level in the cecum.

Barium enema examination in the case of chronic volvulus will satisfactorily demonstrate the pathology, as noted by several authors.

Three general types of volvulus, which involve the cecum, may be described. Most common are those cases in which the volvulus depends upon the abnormal mobility of the right colon due to lack of fixation in one part and excessive fixation at another point. Least common are those cases in which the torsion involves the cecum alone and occurs about its long axis. Intermediate to these is a group of cases in which the underlying defect is represented by an incomplete or malrotation of the colon. The following report illustrates a history and findings typical of cases falling in the latter group.

CASE REPORT

A forty-eight year old white male carpenter was admitted to the Meriden Hospital on August 17, 1948, with the chief complaint of abdominal pain for twenty-four hours. He had been seized with a sudden onset of generalized, mid-abdominal pain at 7:30 A.M. on the morning before admission. The pain had been persistent since that time and had tended to increase in severity. It was accompanied by vomiting the night before and the morning of

* This paper has also been published in the *Meriden Hospital Bulletin.*

FIG. 1. A supine film of the abdomen showing the greatly distended cecum in the mid-abdomen extending well to the left of the midline. The ascending colon is inverted.

admission. On only one occasion since the onset of the pain had the patient passed any flatus and this was only a small amount. Ten years ago, and again three years ago, the patient had experienced similar attacks of pain which were not as severe, and which had subsided spontaneously after taking enemas and laxatives. In the past, his health had otherwise been good, and he had had no previous operations or any serious illness.

On physical examination, the patient appeared to be in acute abdominal distress but was able to sit up in bed with his knees flexed. His blood pressure was 130/80; pulse, 100; temperature, 99.8° F. The abdomen was distended, and in the middle and lower half of the abdomen, there was visible a rounded swelling approximately 20 cm. in greatest diameter. There was generalized, moderate muscle spasm. Only a few high-pitched peristaltic tinkles could be heard. The mass was tympanitic to percussion, slightly tender and not movable. No other organs or masses could be palpated. On rectal examination, there was tenderness anteriorly but no mass could be felt. Microscopic examination of the urine showed a few red blood cells and leukocytes in each high power field. Hemoglobin was 12 gm., with 3.87 million red blood cells and 11,600 leukocytes, with 85 per cent neutrophils. A plain roentgenogram of the abdomen in the erect and supine positions showed a single, large, gas-filled loop of what appeared to be large intestine in the middle of the abdomen (Fig. 1). No free air was seen.

The patient was operated on immediately, with a diagnosis of volvulus of the colon. There was a moderate amount of bloody fluid in the peritoneal cavity. The cecum and ascending colon were tremendously distended. In two places there were ruptures of the taenia. The ascending colon was twisted 180° clockwise on its mesentery. When this twist was corrected, it was discovered that there was a congenital malrotation of the right colon. No other abnormalities were visible. The small intestine

FIG. 2. Postoperative barium enema showing the colon retained in its position of malrotation with the cecal tip in the right upper quadrant. The terminal ileum is seen extending medially from the cecum. A redundant loop of transverse colon can be seen adjacent to the splenic flexure.

was moderately dilated. The cecum and ascending colon were fixed in their position of malrotation by suturing them to the parietal peritoneum in the right flank with interrupted fine silk sutures. This left an opening beneath a the mesentery into the pelvis. This opening was closed with interrupted silk sutures to prevent a herniation of the small intestine. The wound was closed in layers without drainage, employing through and through sutures of heavy braided silk.

Following operation, the patient was maintained on constant suction drainage with a Levin tube in the stomach until the fifth postoperative day. By this time the abdominal distention had been largely relieved. Clear liquids were allowed by mouth and infusions of 1,000 cc. of 10 per cent glucose in water and 500 cc. of amigen were given twice daily for the first six days. On the third postoperative day, an enema was given, with good results, and thereafter enemas were given twice daily until the eighth day. Aside from a slight atelectasis at the lung bases, resulting from the abdominal distention, for the first two days, the postoperative course was uncomplicated. On the thirteenth postoperative day, a barium enema revealed good filling and emptying of the entire colon (Fig. 2).

DISCUSSION

The history of two previous attacks of similar pain indicates that this difficulty was chronic and recurring. Perhaps lesser degrees of volvulus without obstruction had occurred even more frequently. The onset of pain in the early morning, even before rising from bed, is not unusual. The persistence and intensification of the pain is typical.

Identification of the nature of the abdominal mass was not difficult. It was tympanitic to percussion, and high-pitched, peristaltic sounds could be heard directly over it. From its shape and location, however, it seemed more likely to be a dilated loop of sigmoid than ascending colon. Signs of collapse usually associated with the presence of a closed loop of small intestine were absent.

In this case the diagnosis could have been made on the basis of the plain films if it had been considered. The films showed a large loop of colon having the appearance of cecum occupying the mid-abdomen, and extending across the midline from right to left. Two fluid levels were present. A normal cecum can nearly always be seen in the right lower quadrant but is not visible on these films. There was no significant dilatation of the remainder of the colon. In the presence of these roentgen findings and the clinical picture, a diagnosis of volvulus of the cecum should have been made instead of volvulus of the sigmoid. Because of the short duration of the obstructive episode when the patient was first seen, no significant distention of the terminal ileum had developed, and the ileum was therefore not seen lying to the right of the cecum. The ileocecal valve was not visualized nor was the exact site of the obstruction.

The operative treatment resolved itself into two problems: the immediate relief of obstruction; and the prevention of recurrence of volvulus. As soon as the twist was released, it became apparent that gas would immediately pass from the ascending into the transverse colon. Distention of the small intestine except in the terminal ileum was minimal. Even though the pressure within had split the taenia, there was no compromise in the circulation of the ascending colon. Consequently the necessity of performing either cecostomy or resection was not felt.

The position of incomplete rotation of the right colon had been a satisfactory functional one except for abnormal mobility in the past. It seemed logical then to restore this position with the addition of a point of fixation provided along the parietal peritoneum by a line of non-absorbable sutures. Sutures were placed through intact portions of the taenia where they had good purchase. Considering the distended condition of the ascending colon, it would not have been feasible to mobilize a flap of peritoneum large enough to cover it, as suggested by Dixon and Meyer. Maintenance of constant gastric suction until abdominal distention was substantially relieved, together with the use of

6 ounce magnesium sulfate, glycerine and water enemas, starting on the third day, were the most important factors in the postoperative treatment. The use of a double lumen tube for intestinal decompression was considered but felt to be unnecessary because the obstruction had been relieved and free passage of flatus was occurring. The patient was allowed out of bed on the second day and this may have been an additional element in relieving distention.

CONCLUSION

The recognition of volvulus of the cecum is a matter of considerable importance since it represents a grave surgical emergency. The condition is not too uncommon, as demonstrated by reports of over 400 cases from all over the world. This case is reported because of the paucity of reports of volvulus of the cecum in the radiological literature in the hope that the disease may be more frequently recognized in the future.

The particular surgical procedure to be employed depends on the type of volvulus encountered and the circulation through the involved segment of intestine. If the circulation is intact, simple reduction without some type of fixation may lead to repetition of the accident, since the condition is typically chronic and recurrent.

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ARTERIOGRAPHIC VISUALIZATION OF THE CHOROID PLEXUS OF THE TEMPORAL HORN OF THE LATERAL VENTRICLE*

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IT APPEARS that opacification of the choroid plexus of the inferior horn of the lateral ventricle has thus far not been observed by arteriography. In a recently studied case of striothalamic glioma, the clinical, arteriographic and pathologic aspects of which will be reported in detail elsewhere, the choroid plexus of the temporal horn appeared to contain contrast medium, 35 per cent diodrast having been injected into the left internal carotid artery by the percutaneous method.

FIG. 1. Contact film taken in the left lateral view shows, in addition to various other structures, the ramifications of the internal carotid artery.

A contact film taken in the left lateral view shows, in addition to various other structures, the ramifications of the internal carotid artery (Fig. 1). Due to the pressure exerted by the neoplasm, the first curve of the anterior cerebral artery is reversed, while the terminal portion of the internal carotid and, to some extent, the sylvian arteries are displaced downward. The beginning of the anterior choroidal artery which is also dislocated toward the base of the skull appears partly projected upon the posterior communicating artery. Although, in consequence of the abnormal position of the anterior choroidal artery the two vessels cannot be differentiated from each other throughout their course, their composite shadow can be readily identified above the petrous portion of the temporal bone. In tracing this shadow backward, a structure is encountered which is continuous with the former, but much wider in diameter, slightly curved and, as compared to the

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FIG. 2. Photomicrograph showing histologic appearance of the choroid plexus on a coronal section through the brain of a monkey. Pickworth stain. 250μ. (×40)

arterial shadow, hazy in outline. In studying the original film with the aid of a lens, the structure in question is seen to be composed largely of fine interlacing vascular shadows; in some places, however, the vascular channels form aggregates the constituent elements of which cannot be differentiated with certainty from one another.

The shadow described was interpreted as the choroid plexus of the temporal horn of the lateral ventricle because of (a) its continuity with that of the anterior choroid artery, (b) its slightly curved course in a forward and downward direction, duplicating the gentle curve of the temporal horn of the lateral ventricle toward the posterior clinoid processes, (c) its gross resemblance to a previously observed calcified plexus of the temporal horn, and (d) its intrinsic structure.

The evidence as to the last point appears to be corroborated by the histologic appearance of the choroid plexus on a coronal section through the brain of a monkey (Fig. 2). On this section, the red cells filling the blood vessels of the brain including the plexus of the temporal horn appear black.[1] The plexus overlying the hippocampus is seen to be composed partly of medium sized veins, partly of vessels of much smaller caliber the cross sections of which, particularly in the lateral parts of the specimen (the right hand side of the illustration), form tiny closely crowded dots. On the opposite side, longitudinal sections through vessels of a similar caliber may be noted. A few vessels embedded in the plexus appear to be of considerable size, and a number of anchoring venules connect the aggregations of the plexus capillaries and veins with those draining the gray and white matter forming the roof of the inferior horn.

It appears entirely possible that the vessels of the plexus fill in the arterial phase, since the caliber of the plexus capillaries, as may be demonstrated by supravital stains[2] with methylene blue, far exceeds those of the brain substance. It is not unreasonable to assume that, because of the wide caliber of the closely crowded plexus capillaries which, in their entirety, form an extensive vascular net, contrast medium entered the veins of the plexus concomitantly with the arteries, as if an abnormal and sufficiently patent communication within the arterial portion of the cerebral circulation had existed. The study of histologic specimens stained supravitally shows, further, that the few precapillary rami of the anterior choroidal arteries, which may be readily differentiated from the wide capillaries by their strongly developed middle coat, are too small to account for the type of shadow described. The fact that the temporal horn of the lateral ventricle was dilated and that the plexus could float freely and expand in the cerebrospinal fluid is apparently unrelated to the filling of its vessels as, in a recently observed case of verified temporal lobe tumor which had compressed the ipsilateral inferior horn, the plexus could also be identified on arteriography.

The hemodynamic conditions governing visualization of the choroid plexus of the third and of the remaining part of the lateral ventricle are unfavorable, the pos-

terior choroidal arteries, which arise from the posterior cerebrals and irrigate the extratemporal portion of the plexus, being minute vascular channels as compared to the anterior choroidal arteries. The amount of opacified blood passing through the posterior choroidal arteries during a given time unit is apparently too small to produce any noticeable stain of anatomically related capillaries and veins. The same would seem to apply even more to the delicate ependymal arteries contributing to the arterial supply of the choroid plexuses.

Lack of visualization of the plexus in the venous phase is in part implied in the above proposed explanation. It may be due to the fact that (a) in general, the contrast medium rarely enters the plexus in sufficient amounts at all, and (b) that in those cases in which it did enter, the opacified blood, having reached the numerous draining veins, has already left the plexus; in other words, the hemodynamic conditions, as already indicated, resemble those in cases of abnormal communication between artery and artery. The small amount of blood that might leave the plexus in the arterial phase is too small to produce a stain in the many draining veins in which it becomes rapidly dispersed; and, in the venous phase, unindentifiable as a separate fraction, the large amount of blood derived from the capillary bed of the brain having meanwhile entered the veins draining both brain and plexus.

The absence of filling of the plexus in most arteriograms needs further study. It may be related to the generally small size of the anterior choroidal artery filling, perhaps, in only about one-half of the cases or less, the individual size of its precapillary rami, the force and speed with which the opaque medium has been injected and factors of exposure timing. The plexus, regardless of the role the various factors might play, could not have been visualized in the anteroposterior arteriogram, the region of the temporal horn having been projected upon the petrous pyramids and the supraorbital ridges in both cases in which the plexus was seen in the lateral views.

SUMMARY

(1) The appearance in the arteriogram of the opacified choroid plexus of the temporal horn of the lateral ventricle is described.

(2) The local peculiarities of the vascularization which may account for this phenomenon are discussed.

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THE USE OF FUSIBLE METAL AS A RADIOPAQUE CONTRAST MEDIUM AND IN THE PREPARATION OF ANATOMICAL CASTINGS*†

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WHILE searching for a radiopaque substance which would hold its shape when corroded from a pathological specimen it seemed worth while to use alloys of low melting point. This report deals with the results of a series of injections of such an alloy, cerrolow 117‡, into a variety of gross specimens.

Metal has been used for almost three centuries in the preparation of anatomical castings and as a roentgenographic contrast medium for over fifty years. Cole,[3] in his review of the history of injection methods, calls attention to the work of Bidloo,[1] Cowper,[4] Homberg,[9] and their contemporaries, who examined the anatomy of hollow structures by filling them with metals of low fusibility, cooling and then corroding the soft tissues from the casts. In 1720 Valentin[16] published a study of the anatomy of the pulmonary vessels which he had examined in considerable detail as castings, using an alloy composed of lead, tin, mercury and bismuth. Metallic mercury was frequently used by Nuck,[12] Sheldon,[14] and Mascagni[10] to show the distribution of blood vessels and lymphatics.

More recently a series of illuminating reports were published by Glew[6] who, with Ind-Musgrove, made roentgenograms of arteries injected with mercury. Peterson,[13] Neil *et al.*,[11] Brock,[2] Smyth,[15] and others, directed their efforts toward the bronchial tree, in many cases supplementing their demonstrations with Wood's metal castings and corrosions. An admirable review of the history of metal injection and other media suitable for gross, morbid roentgenography will be found in the communications of Gough[7] and Hill.[8]

Cerrolow 117, a eutechtic mixture of metals, resembles Wood's metal chemically but melts at 117° F. (47.2° C.), in contrast to the higher melting point of Wood's metal—150° F. (65.0° C.). Weighing 0.32 lb. per cubic inch (8.88 grams per cubic centimeter), it contains metals in the following proportions: bismuth, 44.70 per cent; lead, 22.60 per cent; indium, 19.10 per cent; tin, 8.30 per cent; and cadmium, 5.30 per cent. The size of its particles, aggregations of atoms rather than molecules, is theoretically determined by the diameter of its largest atoms, modified by factors of temperature, viscosity and surface tension. At temperatures and injection pressures commonly used, the alloy freely enters lumina 25 microns in diameter. Efforts to force it through capillaries have led to ruptures, extravasations and abundant artefacts. The low melting point of cerrolow 117 gives it certain advantages and certain distinct disadvantages. Specimens may be heated to 50° C. in a water bath without undue shrinkage, coagulation or other distortion. At the time of injection the operator, using rubber gloves, can manipulate the specimen, flasks and tubing without discomfort. But it is also true that at room temperatures castings prepared from this alloy, unless specially braced, will slowly bend and settle. It is possible that bending may be prevented by electroplating or embedding in a clear plastic.

An apparatus adapted for the injection of low melting alloys is shown diagrammatically in Figure 1. It includes a hot and cold water faucet, a large water bath, an air pressure source, a thermometer, two mercury manometers and a Starling valve,

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† This investigation has been supported in part by a grant from the American Cancer Society.
‡ Cerrolow 117 is manufactured by the Cerro de Pasco Copper Corporation, 40 Wall Street, New York, New York.

a perfusion bottle and alloy reservoir both connected, by a Y-tube, to a cannula. Two ring stands are necessary to hold the perfusion flask and alloy reservoir steadily in the bath and prevent them from floating as they are pumped empty. By means of clamps applied to the tubing, pressure can be directed into the perfusion flask-cannula promptly and cause a minimum of edema.

Hot water is then allowed to flow into the bath, warming the specimen to 50° C., and the alloy reservoir, filled with melted cerrolow 117, is secured in the water bath. The time required to heat a specimen varies, but thirty minutes to one hour usually suffices if the structure, sub-

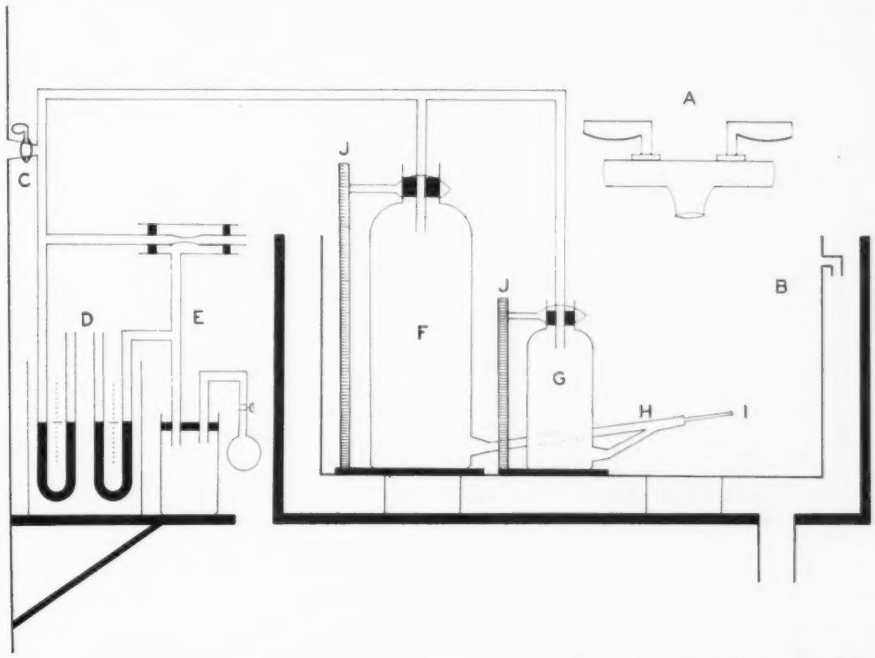

Fig. 1. Apparatus used for injection of cerrolow 117 into anatomical specimens. Within a large sink is placed a water bath (B) below hot and cold water faucet (A). Air under pressure, entering through stopcock (C) may be directed into the kerosene flask (F) or the alloy reservoir (G) by applying clamps (not shown) to appropriate points on the tubing. The kerosene flask and alloy reservoir are supported by ring stands (J). Both flasks are connected to a cannula (I) by a Y-tube (H). A mercury manometer (D) indicates injection pressure, the maximum limit of which is controlled by a Starling valve (E). A thermometer (not shown) completes the apparatus.

circuit or the alloy reservoir-cannula circuit.

Before removal at autopsy, vessels to be injected are ligated to prevent air from entering them. The perfusion flask, alloy reservoir and tubing are filled with kerosene and cleared of air bubbles. The specimen is cannulated *under water* and perfused with cool kerosene at pressures of 120–150 millimeters of mercury till the return flow is free of clots. At this time small "bleeders" are ligated. As Dock[5] has emphasized, we have found kerosene to perfuse merged in warm water, is simultaneously perfused with warm kerosene.

After an appropriate period of warming, the perfusion circuit is clamped at the Y-tube and the Starling valve reset at the desired injection pressure. This should approach the maximum existing in the recipient vessel during life. For venous systems it need not exceed 15 millimeters of mercury, while detail of such fine structures as the renal cortical arteries is best shown at pressures of 200 millimeters of mercury.

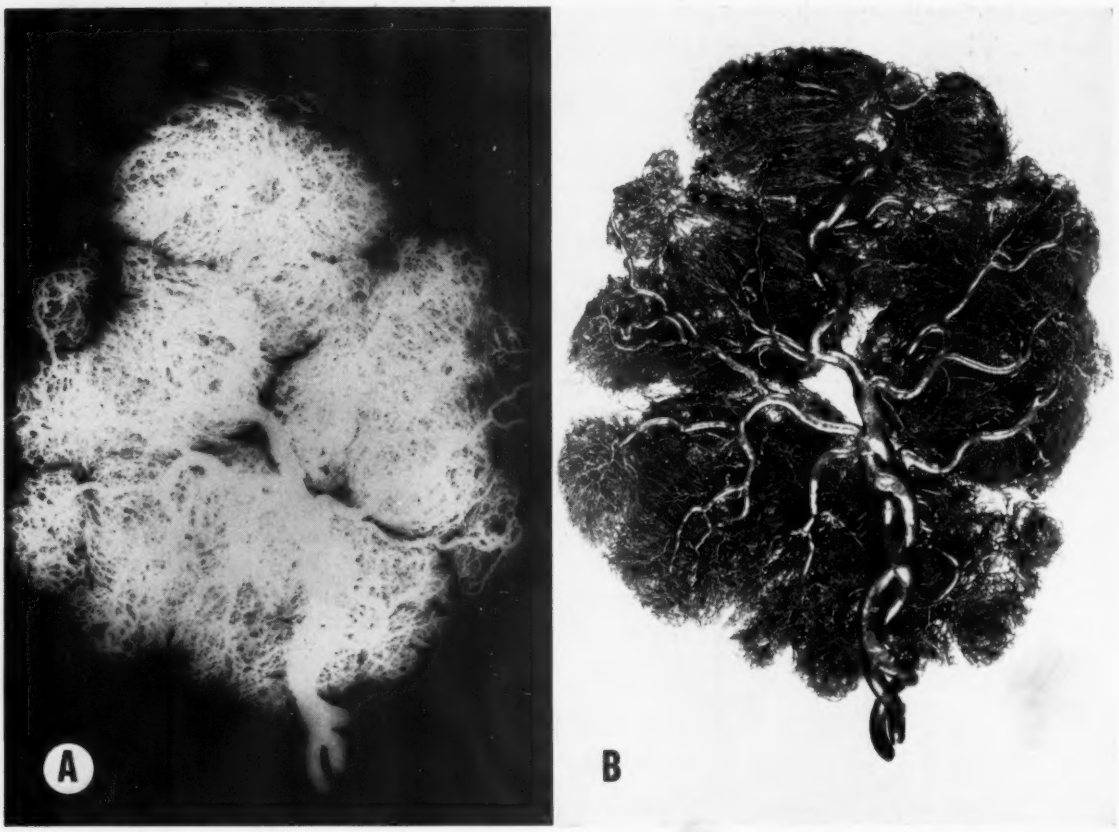

FIG. 2. (*A*) Roentgenogram of the arterial bed of a normal human placenta after the umbilical arteries had been injected with alloy under pressure of 200 millimeters of mercury. (*B*) Photograph of the specimen after corrosion, showing arterial and arteriolar filling in the cotyledons.

FIG. 3. Lateral view of a casting of the cranial arteries of an infant. The child, a four week old female weighing 3,000 grams, died as the result of congenital heart disease. During postmortem examination, alloy was injected into the ascending limb of the aortic arch under pressure of 200 millimeters of mercury. Surrounding tissues were then digested by 20 per cent potassium hydroxide. In this projection the internal carotid, vertebral, middle meningeal, anterior and middle cerebral and a plexus of cerebellar arteries may be identified.

Air pressure is applied to the alloy reservoir and the tube to the cannula opened. As a rule, filling is best when the metal is forced uphill into the organ, pushing kerosene ahead of it and filling the vessel as a solid column free of trapped kerosene droplets. Pressure is maintained as long as residual kerosene emerges from the efferent vessels. The specimen is cooled without reducing pressure on the alloy reservoir and the cannula is removed. Bottles and tubing are reheated and flushed with hot

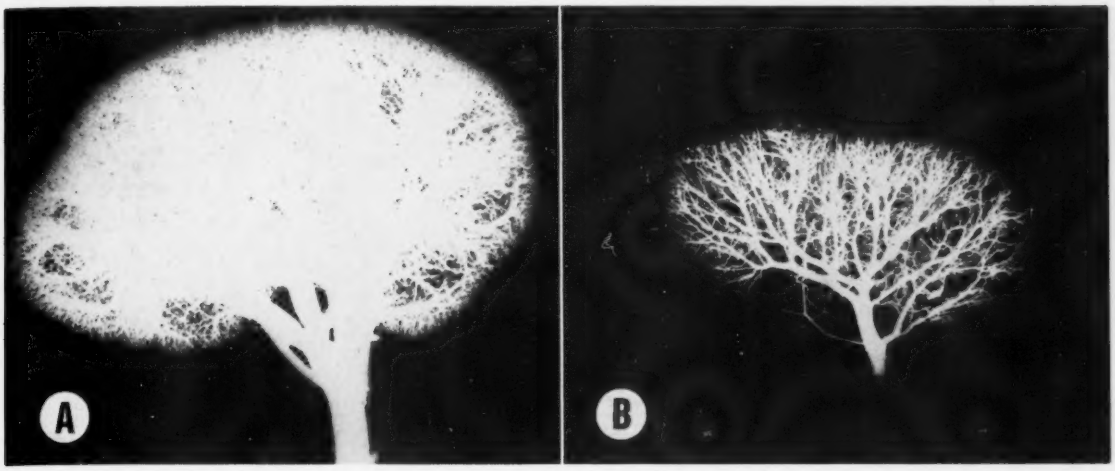

Fig. 4. (*A*) Roentgenogram of a normal kidney after injection of the renal artery with low melting alloy. The kidney was removed at autopsy from a twenty-four year old male who had died of a cerebral abscess. The renal artery, injected under a pressure of 200 millimeters of mercury, appears to have been completely filled in all its ramifications. Note the well defined arcuate and interlobular vessels, and at the top of the roentgenogram, a rather broad, truncated vessel extending above the cortical arteries and representing a large vessel running from the hilum into the perinephric tissues. (*B*) is a roentgenogram of a kidney removed at autopsy from a twenty-six year old female dying of chronic glomerulonephritis and hypertensive cardiovascular disease. The same injection pressure (200 millimeters of mercury) was used as that employed in filling kidney shown in (*A*). Note marked reduction in size of the diseased kidney, coarsening and paucity of the arcuate arteries and almost complete absence of cortical arterioles.

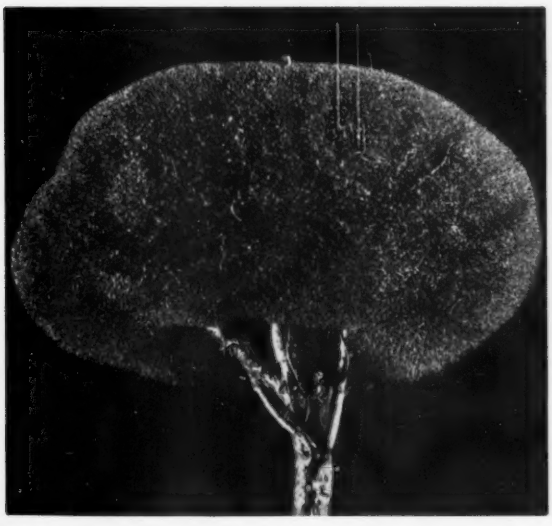

Fig. 5. Cast of the arterial system of a normal kidney. All tissues have been corroded away leaving this metallic casting made up of multitudes of large and small branches of the renal artery. Cortical vessels have been filled and vasa vasorum are shown twined about the larger arteries.

Fig. 6. Arterial bed of normal kidney. The casting has been split by removing one large branch of the renal artery and its divisions, exposing the central portion of the organ. The fine, feathery pattern of the dividing arteries is shown in some detail. This is the same kidney shown in Figure 4*A* and Figure 5.

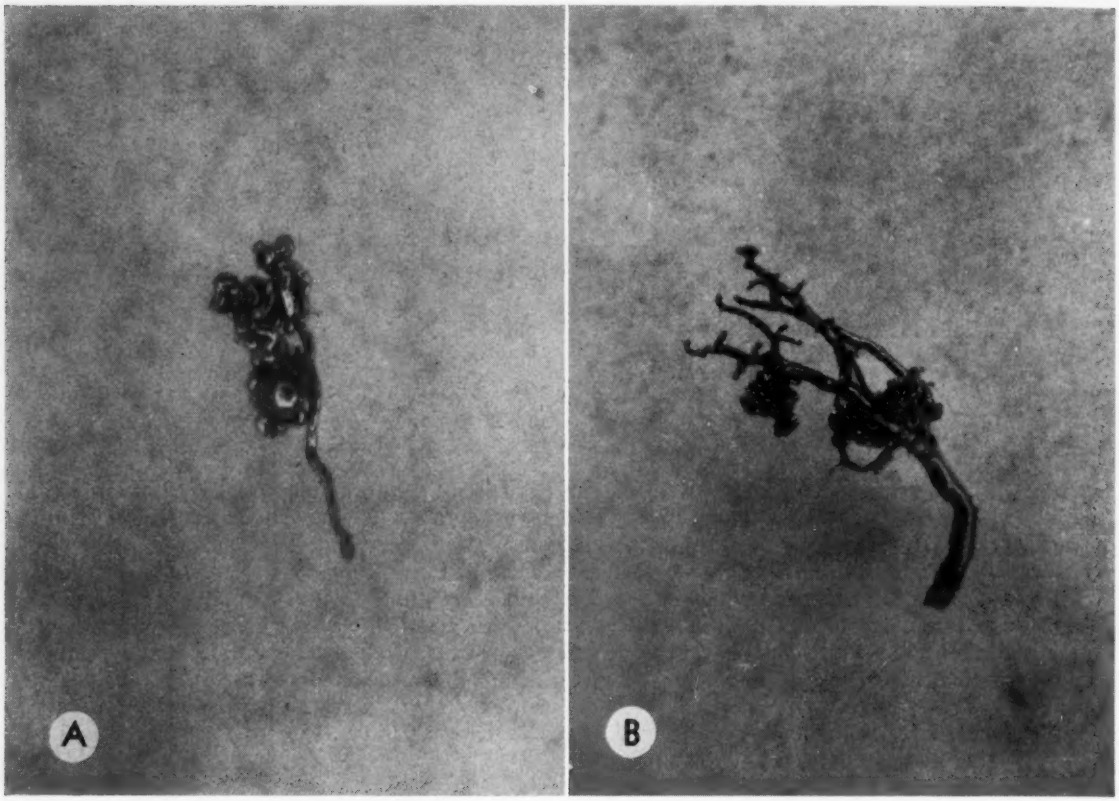

FIG. 7. Castings of micro-anatomical structures of the kidney shown in Figures 4*A*, 5 and 6. In (*A*), enlarged approximately 25×, is shown one of a multitude of nephrons filled by the arterial injection. The glomerulus appears as a sphere, and from it emanates the proximal convoluted tubule that leads into the descending limb of Henle's loop. (*B*) shows an interlobular artery, enlarged 12×, with ramifications into numerous short, afferent arterioles, and to three of these are attached glomeruli and proximal convoluted tubules. Presumably the castings of the proximal uriniferous tubules are formed when the alloy, at pressures of 200 millimeters of mercury, ruptured the glomerular capillaries. Such castings of nephrons, together with afferent and efferent arterioles and other minute arterial structures, could be clearly seen through the dissecting microscope.

water, any excess metal being saved and used repeatedly. Though the cost of the alloy is relatively high, there is no wastage.

Stereoscopic roentgenograms are then made in desired projections. Needless to say, the more gently the specimen is handled the more intact the vessels will remain, but should any break they are easy to reunite after corrosion by applying heat with a fine instrument to the broken ends and fusing them together.

The specimen is corroded in 20 per cent potassium hydroxide. After twenty-four hours of digestion it is hung for a few hours in cold water in which the residue, formed by the combination of fats, proteins and alkali, freely dissolves as water soluble soap. If necessary, the specimen may be resuspended in alkali. We have found that rinsing in even a slowly moving current of water causes breakage of fine arterial castings. Finally, when all tissue has been removed the casting is mounted and photographed.

Representative roentgenograms and castings are shown in the accompanying illustrations. Figure 2 shows the arterial supply of a human placenta and Figure 3, the cranial arteries of an infant. In Figure 4 the arteries of a normal kidney are compared with those of a severely diseased kidney, and in Figure 5 is shown a casting

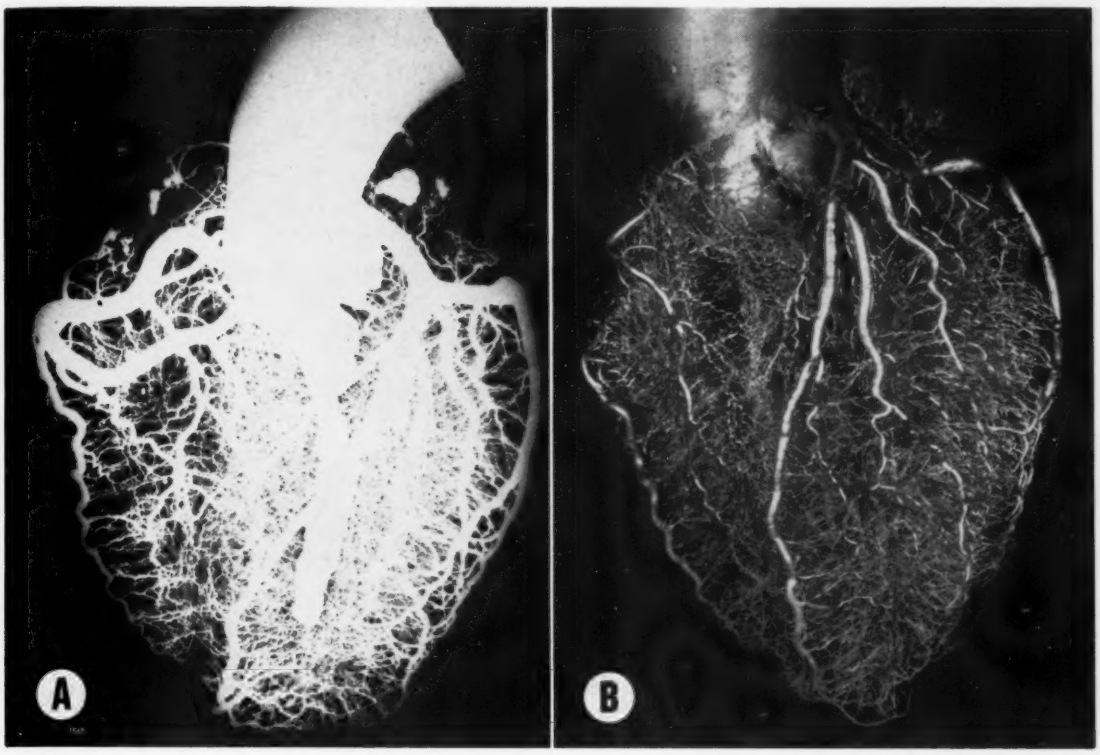

Fig. 8. (*A*) Roentgenogram of the coronary arteries of a normal adult, referred to in Figure 4*A*. Under pressure of 200 millimeters of mercury, cerrolow 117 was injected into the ascending aorta to fill both coronaries. A small amount of alloy passed through the aortic valve and is shown as a longitudinal density in the left ventricle close to the septum. In this illustration the right and left coronary arteries are shown as are their major branches and fine branches into the myocardium. The arteries, after corrosion, are shown in (*B*).

of the arteries of a normal kidney. Additional views of the renal arterial bed appear in Figures 6 and 7, and in Figure 8 are demonstrated the coronary arteries of a normal adult. It is of interest and perhaps value to note that by weighing or melting down such a casting the maximum volume of an arterial bed can be calculated.

SUMMARY

A technique is described for injecting vessels with cerrolow 117, a low melting alloy resembling Wood's metal. The density of the alloy is sufficient to render it radiopaque when injected into anatomical specimens. Castings made of the alloy, when corroded from soft tissues, show intricate anatomical structures in three dimensional form.

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THE USE OF RADIOACTIVE COLLOIDAL GOLD (Au^{198}) IN PLEURAL EFFUSIONS AND ASCITES ASSOCIATED WITH MALIGNANCY*

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HAHN and Sheppard and associates[4,10,11] first reported on the clinical use of radioactive colloidal gold, but their work described only intravenous and interstitial applications. Muller,[8,9] Smithers[12] and Jentzen and Wenger[5] have reported on the intracavitary application of this material. In this country several papers similar to this report have been presented at scientific and medical meetings, but at the time of the writing of this article none of them have been published. However, the Abbott Laboratories[6] have recently produced a brochure on the clinical and experimental use of colloidal gold 198.

The purpose of this report is to present the results of a year's experience with the intracavitary administration of radioactive colloidal gold in which 19 patients with malignancies involving the chest and abdominal cavities received therapeutic doses of this substance. Only 16 cases are presented because of the extremely brief follow-up data on the 3 cases most recently treated.

The primary objective in administering this form of therapy was the reduction of fluid accumulation with the accompanying discomfort and necessity for frequent removal. A secondary objective was the relief of pleuritic or abdominal pain. This latter objective has not been used as a criterion but might be considered in a case with a primary complaint of pain, and little or no fluid formation.

Radioactive colloidal gold was considered appropriate for this type of therapy because of the following facts:

1. The half-life (2.7 days) of gold 198 is satisfactory for clinical use.
2. The emission consists of a moderately energetic beta particle (0.98 mev.) and two soft gamma rays (0.12 and 0.41 mev.). About 90 per cent of the ionization occurs in the first millimeter of the exposed serosal surface.
3. The particulate size of this substance is such that absorption by the vascular and lymphatic systems is negligible.

Procedure. The gold 198 used was prepared by slow neutron bombardment of gold-197 foil in the Oak Ridge nuclear reactor:

$$Au^{197}+n \rightarrow Au^{198}+\text{gamma ray.}$$

After seven to fourteen days' bombardment the resultant gold 198 had a specific activity of about 3.4 mc/mg. After its removal from the reactor the gold 198 was forwarded to the Abbott Laboratories where it was incorporated with gelatin to form the brownish-red-colored radioactive colloidal gold. The pH of this solution was between 5.5 and 6.5, and the specific activity was between 20 and 30 mc/ml.[6] The colloidal particles were stated to be 0.003 micron in diameter.[6] All the gold used in the cases presented in this report was obtained from the Abbott Laboratories.

The problems which proved most difficult involved the removal of the radioac-

* The opinions expressed herein are those of the authors and not necessarily those of the Department of the Navy.

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tive gold from the sealed ampule in which it was shipped and the actual injection into the patient, while observing the prescribed health physics regulations. Several methods of application were presented in the Abbott brochure.[6] Tabern[13] has also designed a

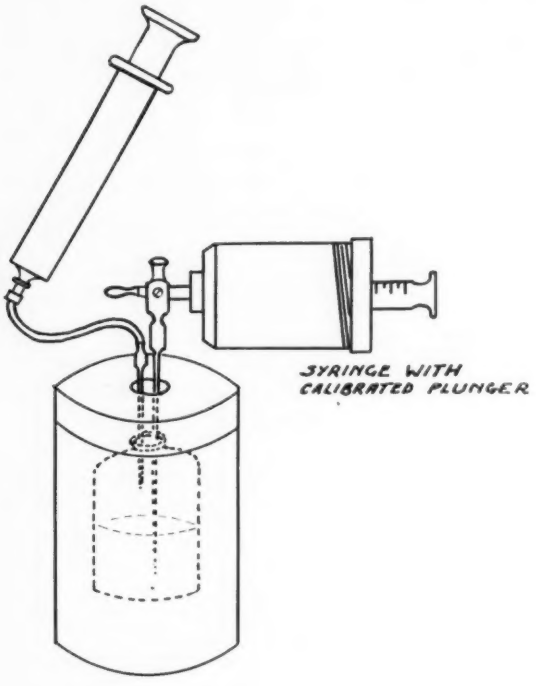

FIG. 1. Improvised set used to transfer radiogold to shielded syringe. The rubber capped vial is placed in a small lead "pig" with an opening in the top. Pressure in the vial is released by the short needle, after which the syringe is attached to act as a pump. A long needle with a slight bevel is inserted to the bottom of the vial. The lead shielded syringe with an attached three-way stopcock is connected to the long needle. The pressure inside the vial is increased by pumping with the syringe attached to the short needle, and the volume of radioactive colloidal gold is determined by reading the calibrations on the plunger of the shielded syringe.

glass flask which simplified the problems of administration and reduced the radiation exposure of personnel involved in this operation.

When a shipment of radiogold arrived, the radioactivity of the contents of the flask was measured by a quartz fiber electroscope, previously calibrated with a known source of radium. The basic technique of this standardization was previously reported.[3] The shipments which arrived at our laboratory approximated the specific activity in millicuries per milliliter as calibrated by the Abbott Company, but there was usually a slight discrepancy between the actual volume contained in the flask and the volume stated by the company. After the activity in millicuries per milliliter had been determined, the desired dose in millicuries was pumped into a shielded syringe, as shown in Figure 1.

The shielded syringe was then transported on a shielded cart to the treatment room. After all but about 200 ml. of the ascitic or pleural fluid had been removed, the needle which was in the patient's chest (or abdomen) was allowed to remain in place and the shielded syringe containing the radiogold was attached to it by a three-way stopcock. A 50 ml. syringe containing sterile isotonic saline was attached to the other connection of the stopcock. The patency of the connection was tested with the saline syringe, the valve of the stopcock was changed, and the gold was injected into the pleural or peritoneal space. The saline in the syringe was immediately injected into the space via the gold syringe, using three rinses. In this manner, the remaining gold in the syringe was flushed out as was any remaining in the needle. The needle was withdrawn and a simple dressing applied.

At the present time the colloidal gold is removed from the shipping vial by a special pipette designed by Tabern[13] (Fig. 2), and transferred to a special flask, also designed by Tabern. It is then administered according to his technique (Fig. 3). The shielded syringe method has been discarded.

Dosage. In determining the dosage of radioactive gold, three factors were considered: (1) the amount of stable gold injected; (2) the radioactivity in millicuries injected; and (3) the approximate radiation dose to the tissues.

Regarding the dose of stable gold which

was injected into the cavity it may be stated from data presented under "Procedure," that for every 100 millicuries of radiogold there were approximately 20 milligrams of stable gold. This assumed that the administration would take place about thirty-six hours following removal of the isotope from the nuclear reactor.

There have been various opinions regarding the millicurie dose of radiogold to be given for maximum therapeutic benefit. Chamberlain[6] and Andrews[1] have stated that the dose should be in the range of 100 to 150 millicuries. As may be seen from Table 1, these patients received somewhat smaller doses. However, it may be noted that some of the 16 patients included in this report received more than one injection. Case 6 received a total of 157 millicuries to the right pleural space and a total of 138 millicuries to the left pleural space. Case 12 received three injections totaling 242 millicuries.

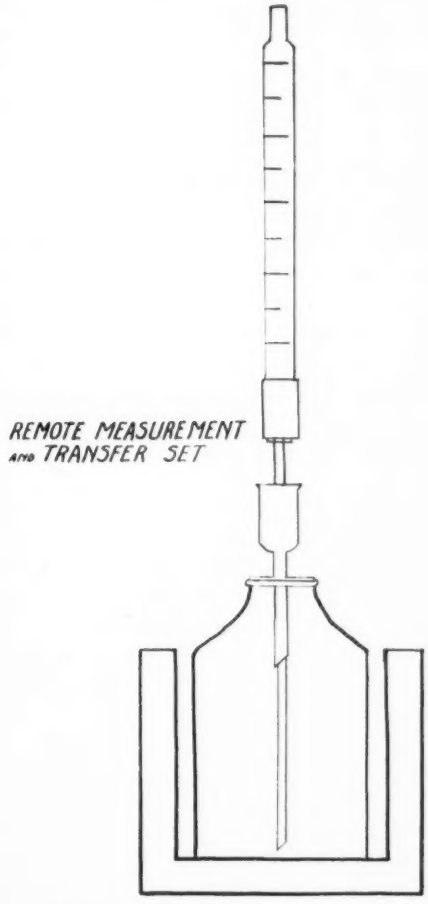

Fig. 2. Abbott pipette used to remove radiogold from vial. Excess pressure in the vial is released by inserting a large bore, short length needle. The pipette with a long needle attached is inserted through the large bore needle, and the desired amount of colloidal gold is removed. The pipette is controlled by a remote control apparatus and the radiogold is transferred to the container shown in Figure 3. (Courtesy Abbott Laboratories and *Nucleonics*.)

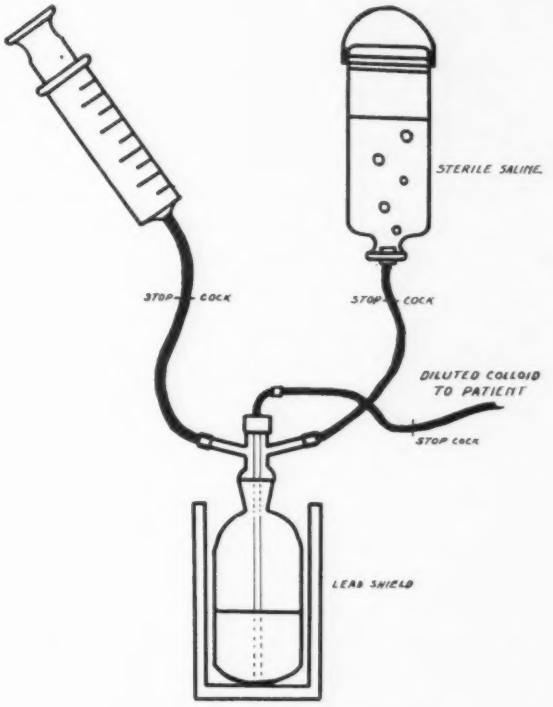

Fig. 3. Abbott type container. The desired activity of radioactive colloidal gold has been transferred (Fig. 2) to the glass container which is shielded by lead bricks. The stopcock on the tubing leading to the patient is closed. Saline is drawn into the gold container by applying suction on the 50 ml. syringe attached to the third outlet by a long plastic tubing. The stopcock on the saline tube is closed and the stopcock on the tube leading to the patient is opened. Gentle pressure on the syringe will force the diluted radioactive colloidal gold into the patient. This procedure is repeated for three rinses of about 50 ml. each. (Courtesy Abbott Laboratories and *Nucleonics*.)

TABLE I

THERAPEUTIC USE OF INTRACAVITARY RADIOGOLD (COLLOIDAL Au^{198})

Patient	Diagnosis	Date Treated	Dose (mc.)	Treatment Site	Patient Status	Remarks
1. H.W. F 42 yr.	Cystadenocarcinoma of ovary with ascites	2-8-51	60	Peritoneal space	Died 9-15-51	Transient relief of pain following therapy
2. M.F. F 45 yr.	Metastatic carcinoma of breast with pleural effusion	3-9-51	54	Rt. pleural space	Died 3-14-51	Thoracentesis semiweekly prior to therapy. Died 5 days later without further taps
3. T.V. M 62 yr.	Rhabdomyosarcoma, chest wall with effusion	3-30-51	41	Rt. thoracic cavity	Died 6-26-51	Given prophylactically, post-pneumonectomy. Difficult to evaluate
4. M.H. F 63 yr.	Metastatic carcinoma of breast with effusion	5-16-51	94	Rt. pleural space	Died 6-30-51	Two thoracenteses required prior to therapy to right chest. Transient relief. Then required thoracentesis on left. Lt. side not treated because of moribund state
5. L.G. M 62 yr.	Bronchiogenic carcinoma with effusion	5-24-51	90	Rt. pleural space	Died 9-12-51	Frequent thoracentesis required prior to treatment. Moderate subjective improvement, no further thoracenteses for 4 months
6. Z.L. F 58 yr.	Metastatic carcinoma of breast with pleural effusion	5-31-51 8-2-51	94 75 63 63	Rt. pleural space Lt. pleural space Rt. pleural space Lt. pleural space	Died 10-6-51	Repeated bilateral thoracenteses required prior to first treatment. No more until second treatment. One bilateral tap producing one-half the usual amount before death 2 months later
7. O.J. M 56 yr.	Bronchiogenic carcinoma with effusion	7-19-51	60	Rt. pleural space	Living	Complicated by active pulmonary tuberculosis. No taps required after therapy, both Au^{198} and 400 kv. roentgen therapy
8. R.B. M 32 yr.	Lymphoblastoma, mediastinum with fluid formation	7-26-51 11-29-51	72 74	Rt. pleural space Rt. pleural space	Living and working, symptom-free	Thoracentesis required every 6 to 10 days for 5 months before therapy. None required between first and second treatments. None therafter (3 months)
9. F.R. F 58 yr.	Metastatic carcinoma of breast with effusion	9-13-51 11-14-51	94 93	Rt. pleural space Rt. pleural space	Died 1-21-52	One thoracentesis prior to first treatment. Seven between first and second treatments. Slower rate of taps with smaller amounts thereafter until death
10. H.B. M 69 yr.	Bronchiogenic carcinoma with effusion	10-11-51	107	Lt. pleural space	Died 10-26-51	Two thoracenteses prior to therapy. One after therapy showed fluid to be thinner and free of blood. Died 15 days after treatment
11. L.S. F 70 yr.	Bronchiogenic carcinoma with effusion	10-12-51 11-30-51	93 85	Rt. pleural space Rt. pleural space	Living and ambulatory, symptom-free	Required occasional taps before treatment with both Au^{198} and 400 kv. roentgen therapy. No taps between first and second treatments. No taps since (3 mo.). Marked objective improvement
12. M.M. F 60 yr.	Cystadenocarcinoma of ovary with ascites	11-14-51 11-24-51 12-13-51	94 46 102	Peritoneal space	Living	Repeated paracenteses required prior to therapy. Rate of fluid formation considerably slowed after 2nd treatment and fluid became blood-free (1 tap 2 wk. after treatment none for 2½ months). Patient reports good appetite and weight gain
14. H.L. F 50 yr.	Adenocarcinoma of rectum with metastases and ascites	12-6-51	98	Peritoneal space	Died 1-11-52	Complete resorption of ascitic fluid and dramatic relief of symptoms after therapy. Ascites began returning gradually after 2 weeks. Not treated because of moribund state

Table I—Continued

Patient	Diagnosis	Dated Treated	(mc.)	Treatment Site	Patient Status	Remarks
15. A.O. F 39 yr.	Metastatic carcinoma of breast with pulmonary metastases and effusion	1-10-52	113.6 113.6	Rt. pleural space Lt. pleural space	Living	Two thoracenteses required prior to therapy. Two bilateral treatments. Marked subjective improvement. No further taps to date (2 mo.)
16. M.F. F. 48 yr.	Metastatic carcinonoma of breast with pleural effusion	1-18-52	148.8	Rt. pleural space	Moribund	Was being tapped every 8 days before treatment. Should have had second treatment but was moribund. No improvement

The calculation of the tissue dose of radiation was difficult. According to the basic formulae of tissue dose calculation, as presented by Marinelli, Quimby and Hine,[7] the volume and weight of the irradiated tissue must be approximated. In order to use these formulae in calculating the tissue dose to the pleura or the peritoneum, the total surface area of these organs would have to be known. A search through the literature did not reveal any basic attempt at estimation of such surface areas.

Chamberlain, in the Abbott brochure,[6] calculated the tissue dose in terms of millicuries injected per 1,000 square centimeters of serosal surface, using the basic formulae of the above reference. At the time of this report this appeared to be the most practical approach. The results of his determinations were:

1. Serosal membrane surface dose (beta) —900 e.r./mc/1,000 cm.^{2}
2. 1 mm. depth dose (beta)—10 per cent of above.
3. Total body dose (gamma)—25 r/100 mc. injected.

As Chamberlain pointed out, an area of 30,000 square centimeters, which may approximate the area of the average peritoneum, would receive a beta dose to the surface of 3,000 e.r. per 100 millicuries of colloidal gold injected.

Excretion. Studies on the early patients in this series revealed that practically no radiogold was excreted in either the urine or feces. This has also been reported by other investigators.[1,6,8,12]

Care of the Patient. Immediately following the treatment the patients were positioned in the following manner: on the left side for fifteen minutes, on the right side for fifteen minutes, with the head of the bed elevated for fifteen minutes,and with the foot of the bed elevated for fifteen minutes. This cycle was repeated for about four hours to insure distribution of the colloidal material over as much of the pleural or peritoneal surface as possible. Other than this measure, no departures from the routine medical and nursing care were necessary.

About one-half of the cases treated demonstrated a reaction ranging from mild nausea to nausea, vomiting, malaise and headaches. This usually occurred on the second or third postinjection day and lasted about one day. Only symptomatic treatment was administered.

The hemograms following injection were difficult to evaluate as the patients were usually severely ill and anemic from their disease. It was noted, however, that a transitory leukopenia developed four to six weeks after therapy.

Personnel Protection. The patients treated to date have presented no special nursing problem. They were monitored immediately following treatment and the maximum permissible isodose distance established. This is the distance from the patient at which a reading of 6.25 milliroentgens per hour is obtained. Visitors were required to remain beyond this distance, and nursing personnel, wearing film badges, were limited to routine nursing procedures, performed without undue delay. Only 1 or 2 patients were sufficiently ill during their periods of significant radioactivity to require constant care, and in these cases attendants were carefully ro-

tated. No instances of exceeding or approaching maximum safe dosages were encountered among the attending personnel. The patients were placed in rooms which were not shielded but were isolated.

Brucer[2] has reported on these hazards, and the protective measures necessary in the clinical use of radioisotopes.

REPORT OF CASES

The following are the reports of 4 selected cases that we feel are typical.

CASE 8. R.B., a white male, aged thirty-two, was admitted on July 26, 1951, with a history of lymphosarcoma (proved by biopsy) of two years' duration. In the two years prior to this admission the patient had received two courses of nitrogen mustard (October, 1948, and May, 1950) and a course of roentgen therapy to the mediastinum and right chest for pleural effusion (April, 1951). The physical factors involved are not known. In the four months preceding admission the patient had required right thoracentesis every two to three weeks and had become quite emaciated.

Physical Examination. The patient was thin and pale. Shotlike axillary and anterior cervical lymph nodes were palpable. The liver and spleen were moderately enlarged. Marked right pleural effusion was noted.

Laboratory Findings. The white blood cell count was 4,750 with 52 per cent lymphocytes.

Hospital Course. On July 26, 1951, 72 millicuries of Au^{198} was injected into the right pleural space. Following this, no immediate taps were required. However, because of the slow re-accumulation of fluid an additional dose of 73.8 millicuries of Au^{198} was instilled into the right pleural space on November 29, 1951. The patient has required only one thoracentesis in the past six months and has begun to regain his strength and sense of well-being.

CASE 11. E.J.S., a white female, aged seventy, was admitted on September 28, 1951, with a seven month history of weakness, anorexia, weight loss and right-sided pleuritic pain.

Physical Examination. The patient was moderately emaciated and the right chest was filled with fluid.

Laboratory Findings. The urinalysis, complete blood count, and sedimentation rate were normal.

Roentgen Findings. There was a fluid level extending up to the second rib anteriorly on the right, and a superior mediastinal mass presenting to the right.

Hospital Course. On October 2, 1951, 1,000 milliliters of fluid was removed and was reported positive for malignant cells. On October 12, 1951, a repeat tap was performed and 93 millicuries of radioactive colloidal gold was instilled. Roentgen therapy was given, with a tumor dose of 3,000 r, using 400 kv., 5 ma. and a half-value layer of 3.7 mm. of copper. The patient was discharged, to be re-admitted on November 28, 1951. During the interval she had felt much less respiratory distress and pleuritic pain and had noted a feeling of general well-being. No further thoracenteses had been necessary. Laboratory findings were unchanged and the roentgenogram showed a decrease in fluid since the film made after the last thoracentesis. On November 30, 1951, another 85 millicuries of Au^{198} was instilled into the right chest. This was done for persistent fluid and pain. The patient was discharged on December 4, 1951, feeling well. No taps have been required in the past three and one-half months, although there has been some recurrence of pain.

CASE 12. M.M., a white female, aged sixty, was admitted on October 23, 1951, with a history of having had an ovarian carcinoma discovered nine months before during an exploratory laparotomy for persistent lower abdominal pain. At that time peritoneal implants were present. Following the operation, the patient received 6,000 r of roentgen therapy to the pelvis. The physical factors involved are not known. In spite of this, the patient developed progressive ascites. At the time of admission, her chief complaints were the abdominal discomfort and dyspnea associated with the ascites.

Physical Examination. The patient was markedly emaciated and dyspneic. There was a tremendous amount of ascites which tightly distended the abdomen and markedly elevated the diaphragms. A left lower quadrant, hard, nodular mass could be palpated by external and by pelvic examination.

Laboratory Findings. These were normal except for a hemoglobin of 9–10 grams.

Hospital Course. Roentgen studies revealed no evidence of extra-abdominal metastases. Two abdominal paracenteses were required in a

period of two weeks time for relief of discomfort and dyspnea. On November 14, 1951, 90 millicuries of Au^{198} was injected into the peritoneal cavity, and on December 13, 1951, 100 millicuries. No interval taps were required. The patient was tapped on the day of discharge and two and one-half weeks after discharge. Following the last abdominal paracentesis, fluid accumulation has been very slow and repeat tapping has been unnecessary in this two and one-half month interval.

Case 14. H.L., a white female, aged fifty, was admitted on November 19, 1951, with a twelve month history of diarrhea, anorexia and weight loss. During the months preceding admission, the patient developed progressive abdominal swelling followed by constant hiccoughs.

Physical Examination. The patient was extremely emaciated. Large nodular masses were palpable throughout the abdomen, and the rectum was almost completely filled by a hard, annular mass. The abdomen was tightly distended by ascitic fluid.

Laboratory Findings. Complete blood count and urinalysis were normal except for a hemoglobin of 11 grams. Biopsy of the rectal mass revealed adenocarcinoma, probably of intestinal origin.

Hospital Course. The patient's abdominal distention grew more severe, producing increasing discomfort, anorexia and hiccoughs; therefore, on December 6, 1951, 97.7 millicuries of Au^{198} was administered intraperitoneally. Six days following this procedure, there was rapid disappearance of all abdominal fluid. The patient's discomfort and hiccoughs disappeared, and her appetite improved slightly. About two weeks after therapy the fluid began to reaccumulate slowly. Although two subsequent taps were required, no attempt to re-treat the patient was made because of her moribund condition. The patient died on January 8, 1952. Permission for autopsy was not granted.

DISCUSSION

This report concerns 16 cases treated with colloidal gold 198 (see Table 1). They were selected cases only to the extent that each presented some degree of pleural effusion or ascites associated with malignancy. No other criteria for accepting cases were employed other than those concerning blood counts, etc., standard for all radiation therapy. These were waived to a certain extent in treating several frankly moribund cases in whom it was felt that the life expectancy would not be altered.

Of the cases treated, 6 were metastatic breast carcinoma with pleural effusion, bilateral in 2 cases. Four cases were bronchogenic carcinoma with effusion, 2 were cystadenocarcinoma with ascites, 1 was lymphoblastoma of the mediastinum with fluid formation, 1 was generalized Hodgkin's disease with pleural fluid, 1 was adenocarcinoma of the rectum with extensive abdominal involvement and ascites, and 1 was rhabdomyosarcoma of the chest wall with effusion. Ten of the patients had undergone major surgical procedures for their disease and 13 of them had received full courses of roentgen therapy and/or nitrogen mustard. Five of the patients received roentgen therapy with or soon after the radioactive colloidal gold therapy. Those cases which were not frankly terminal, or very nearly so, constituted a rather small minority in this series. All cases were approved for therapy by the hospital's Board for the Control of the Clinical Use of Radioisotopes.

The response to this therapy has, in general, been rather encouraging, especially in those patients who were treated before reaching a terminal state. Four of the patients, Cases 5, 8, 12 and 14, obtained marked relief, both from the standpoint of reduction or cessation of fluid accumulation and relief of pain. In case 14, however, relief lasted only two and one-half weeks, when death intervened. Case 5 died four months after treatment without requiring further taps.

Four patients, Cases 6, 11, 13 and 15, experienced moderate relief, the intervals at which taps were required being considerably lengthened. In 2 cases, still living, no taps have been necessary for two and one-half and three and one-half months respectively. Case 11, however, has continued to have considerable chest pain.

Four patients, Cases 1, 4, 9 and 10, responded only very slightly to this therapy, with varying degrees of reduction of the rate of fluid accumulation and relief of pain. It should be stated, however, that 3 of these patients were moribund when treated.

One patient, Case 16, obtained no relief from a dose of 148.8 millicuries of Au^{198}. Another, Case 3, was treated following pneumonectomy as a prophylactic measure, and the results cannot properly be included in an evaluation of this procedure.

Case 7 was complicated by the presence of pulmonary tuberculosis, but he has required no thoracenteses for eight months.

Case 2 died five days after therapy and therefore could not be properly evaluated.

SUMMARY

1. Radioactive colloidal gold is appropriate for treatment of patients with pleural effusion or ascites associated with malignancy, because of its half-life, its emissions, and the size of the colloidal particles.

2. This is a report of sixteen cases treated with this material. Twenty-five per cent of the patients experienced marked relief, both from the standpoint of the reduction of fluid accumulation and relief of pain. Twenty-five per cent experienced moderate relief of these symptoms and the results in the remaining 50 per cent varied.

3. From the results of this study it is apparent that the intracavitary use of radioactive colloidal gold should be accepted as a valid radiotherapeutic procedure.

4. Any conclusions as to prolongation of life or actual destruction of malignant tissue resulting from this use of radiogold must await longer follow-up data and a larger number of case studies and autopsies.

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DIAGNOSTIC USE OF RADIOACTIVE ISOTOPES*

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THE radioactive isotopes give us a means of attempting a precision diagnostic procedure on those cases not amenable to standard forms of clinical or roentgenological diagnosis.

For the purposes of this paper, we shall confine ourselves to the use of radioactive iodine in thyroid disease. Aside from a single example, we will not discuss the use of radioiodine in thyroid malignancy, since this subject is too large to be encompassed within the limits of this presentation. It will be treated in a separate paper later.

Prior to 1946, the clinical use of radioisotopes at Harper Hospital was of very little importance, although laboratory work was started in 1937 and our first human case was studied in March, 1940. With the release of carrier-free radioactive iodine (I^{131}) by the Atomic Energy Commission in 1946, we were able to begin studies on a series of cases which now number 953. Of that number, 817 received radioactive iodine (I^{131}) and 136 radioactive phosphorus (P^{32}) tracer studies.

Some of these, by the very nature of the case, demanded serial studies over a period of time which now extends to almost four years. Consequently, the 817 I^{131} patients† represent 1,067 complete tracer studies. The over-all accuracy of the study up to this time is evidenced by the fact that of the 817 patients, the tracer findings which were written prior to operation or to final outcome of the case in every instance have been shown to be in error three times. In each of these cases, the error was due to faulty personal observation or lack of experience and not, fundamentally, to the technique. Two cases are unsolvable quibbles with approximately equal evidence on both sides and in 4 cases we were not able to come to any definite conclusion. These inconclusive cases were in the early part of the study and would not cause us much trouble now, but if we included everything that was not proved to be absolutely right and consider all of these to be absolutely wrong, then the net error of the method is 1 per cent.

Sixteen cases are at this time unsolved, either due to lack of definite confirmatory information or to the fact that the cases are still in process of observation, and these are not included in the statistics.

Our technical procedures are as follows: A shipment of radioactive material received from Oak Ridge is diluted to a standard volume, usually 200 milliliters. After thoroughly mixing, an aliquot is taken and a test sample prepared by making a standard dilution. This is usually 1 to 1,000, depending upon the size of the shipment. From this, volumes of 0.1 ml. are transferred to counting plates and are dried under carefully controlled conditions. An absolute beta count is then performed. From this the content in microcuries per milliliter of the standard volume can be computed and doses are measured accordingly.

The usual tracer dose is 50 microcuries. We have, in the process of duplicating other workers' observations,[8,9,12,16] used tracer doses as high as 100 to 500 microcuries or more, but have found no advantage. In many cases we found real disadvantages in these higher doses; hence, of the 1,067 I^{131} tracer studies in question, 1,016 have been carried out with the Harper Hospital system of dosage and 51 with higher doses. The 50 microcurie dose is assumed to be intended for an average

† Statistics as of September 1, 1950. The total number of I^{131} tracer studies has now increased to 1,382 and the net error has decreased slightly.

* Presented at the Fifty-first Annual Meeting, American Roentgen Ray Society, St. Louis, Mo., Sept. 26–29, 1950.

individual. When children are to be studied, the dose is scaled down in ratio to body weight. The minimum limit on this system is 5 microcuries, which is the smallest dose that we use.

The dose measured out from the standard volume is diluted with water and given to the patient on an empty stomach early in the morning. The glass is washed with 2 or 3 ounces of orange juice in small washings. It has been found that, with proper preparation of the glasses and the use of this technique, no significant part of the tracer is ever lost by adsorption.

In most of the early work, observations were made within the first hour after administration of the dose. This was quickly shown to be an impractical procedure, largely because of great variations in the rate of absorption from the patient's gastrointestinal tract. It can easily be demonstrated that a nervous person with toxic hyperthyroidism can have gastric retention for as long as four hours, and consequently the early observations will not show significant uptake in the thyroid.

Radioactive iodine is not absorbed to any appreciable degree from the stomach and, in fact, is secreted along with hydrochloric acid by the gastric mucosa. Figure 1

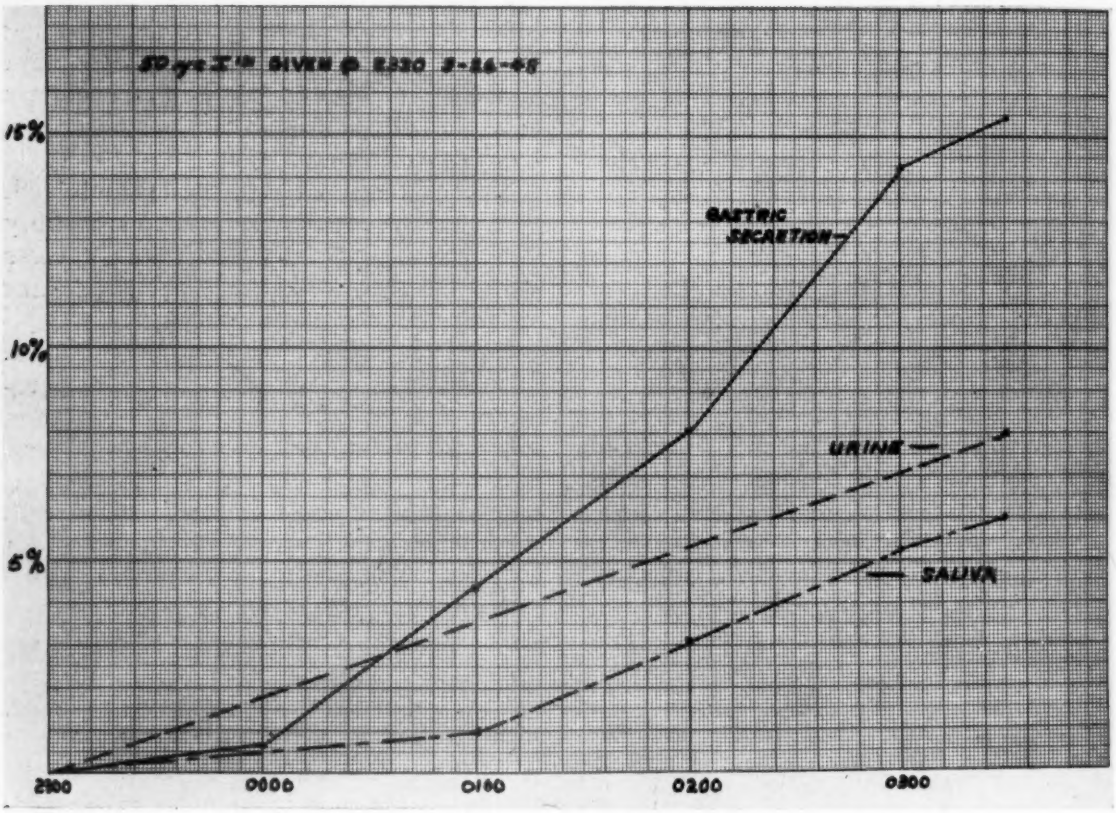

FIG. 1. Gastric secretion curve.

shows an actual study conducted for the purpose of measuring secretion and absorption. In this case, the patient was one of a number of trained subjects used in our laboratory for studying gastric secretion.* He was capable of sleeping with a balloon in his esophagus and a suction tube in his stomach. Just prior to 11:00 p.m. his stomach was washed, the tubes were inserted,

* We are indebted to Dr. Sandweiss and Dr. Sugarman for making this study possible. Dr. Sugarman inserted the balloon and cared for all of the medical aspects of the case.

and suction started. At exactly 11:00 p.m. he was given 50 microcuries of I^{131} intravenously and it will be seen that the tracer substance appeared in the saliva and gastric secretion almost immediately. This type of experiment, of course, is self-limiting, since the substance being studied is being removed by the study, and so the observations were terminated at the end of four hours, but it is shown that 6 per cent of the dose appeared in the saliva, 16 per cent in the gastric secretion and 8 per cent in the urine in this period of time. In regular tracer observations, the same effect can be demonstrated simply by taking a count over the epigastrium of a nervous patient or one who has surreptitiously ingested food. For this reason an epigastric count is done routinely.

For these reasons, we now begin our counter observations at the end of the first two hours and subsequently continue them through at least thirty-two hours. A minimum of five complete observations is made on each patient.

The type of counter used is illustrated in Figure 2. While it has undergone considerable technological improvement, it has not been changed fundamentally since 1940. Many types of devices have been tried, including long collimating caps and tubes over the counter and counterbalance arrangements to sustain the weight of the counter head. All have been found useless. The greatest trouble with any sort of mechanical holding of the counter head is the fact that it deprives the observer of flexibility. In finding small localizations, particularly the detection of peritracheal nodes, concealed toxic localizations, and small bone metastases which have not yet appeared in the roentgenogram, a maximum of flexibility is essential. Our development, therefore, has been along the line of elimination of excess weight and from an original 14 pounds we have now decreased the weight of this counter head to $4\frac{1}{4}$ pounds, which is perfectly practical for hand operation. Construction of the counter head, including the preamplifier stage, which is a 6AG5 Type tube, is indicated. The counter tube is guarded by a minimum of $\frac{1}{2}$ inch of lead and this has proved to be adequate for the type of work described here. This minimum, however, is absolutely essential to the method.

Fixed distance counters are used for observation in therapy cases. These have heavy collimators running to several inches of lead in thickness, and lead filters variable from 0 to 10 mm. It has been our experience, however, with that of others, that fixed distances of 22 to 50 cm.[1,7,10,15] are impractical and often very misleading. We have found that distances of 60 to 80 cm., which do give the most reliable results on large doses, are not practical for 50 microcurie doses. In addition, the problem cases, which are the proper subject for isotope laboratory diagnosis, very commonly have aberrations of the thyroid which can only be detected by a scanning type of counter.[2] The fixed distance counter, therefore, has little practical value in diagnostic procedures.

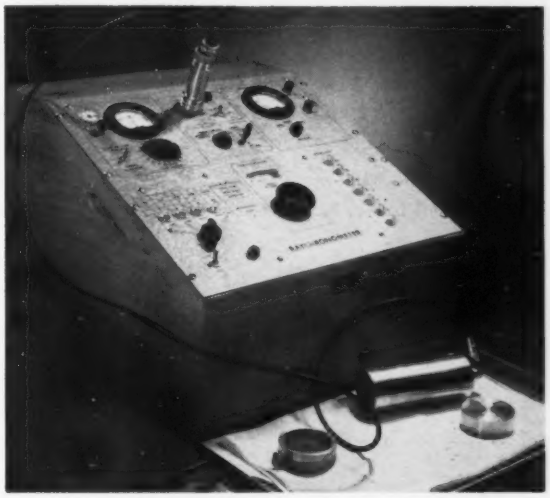

Fig. 2. Geiger-Müller counter and counter head.

The technique of using the counter on a patient is illustrated in Figure 3. Specific anatomical locations are used as a general frame of orientation. The window end of the counting tube is held as close to the skin as possible. Obviously, ordinary pre-

FIG. 3. Diagnostic Geiger counter technique demonstrated on patient.

cautions against surface contamination have to be observed but these are easily managed. Studies both on live patients confirmed at operation and on sponge rubber models have shown that, by this method, localizations of toxic hyperactivity as small in diameter as 5 mm. can be located in a mass of relatively normal glandular tissue, when the localization is much too deep to be detected by any other means.

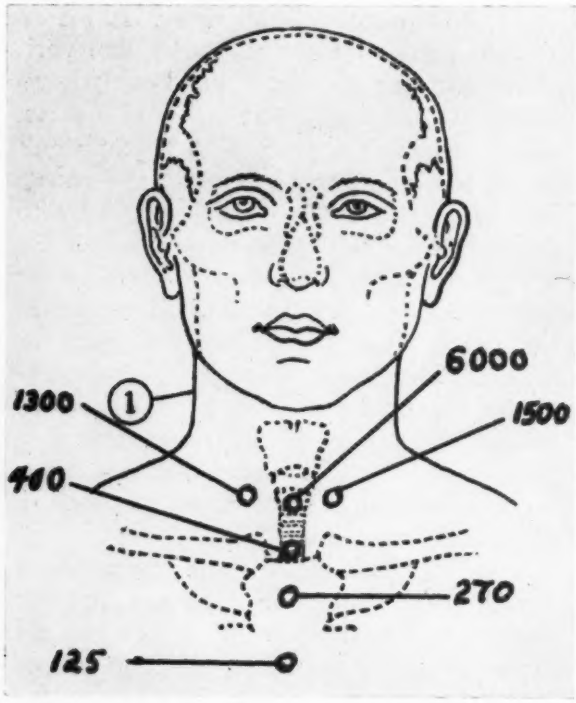

FIG. 4. Geiger counter map of a normal patient.

As the count proceeds, a count map such as shown in Figure 4 is prepared. The formal frame of reference, depending upon the anatomical landmarks, is used as a guide to the study and is not permitted to become a limitation. Perhaps the most important single part of the study is a very careful scanning of the thyroid region, the posterior cervical and supraclavicular areas, and the thorax anteriorly. These observations are made without exception in every case.

This use of the diagnostic Geiger counter is exactly comparable to the use of the roentgenoscope and its purpose is to detect the presence and outline the location of the tissues which metabolize the isotope. The most important item in the entire technique is to perform this procedure carefully and without previous prejudice. A mediastinal mass which has every possible roentgenologic characteristic of retrosternal thyroid may, in fact, be something entirely different. Retrosternal toxic recurrences and peritracheal lymph node invasions are commonly not visible in the roentgenogram, and it is at this stage in the tracer procedure that their existence is detected. After these lesions have been detected and their exact position outlined with reference to the anatomical landmarks, quantitative studies over a period of time are performed to determine the nature of the tissue involved.

If cancer is suspected, the rest of the patient's body and all accessible parts of of the skeleton may also be scanned. In every case the concentration remaining in the liver, spleen and thigh is observed. If warranted, an observation is made over the apex of the heart and over the epigastrium. From these observations enough data are obtained to show the observers whether or not other specific locations must be investigated and, if so, further detailed studies are made.

Usually, the two hour count shows a large portion of the radioactive tracer in the liver, the left upper quadrant and the soft tissue. If subsequent observations show a high retention in the soft tissue, then we are at once informed that an abnormal situation exists, either the patient has a chemical block (such as we first described tracer administered must be accounted for and this is done by recording the amount present in the thyroid, the residual amount in the patient's body and general circulation, and the amount excreted. Since fecal excretion has been previously shown to be small,[5] a 5 per cent allowance is made and a net error of minus 5 per cent is permitted

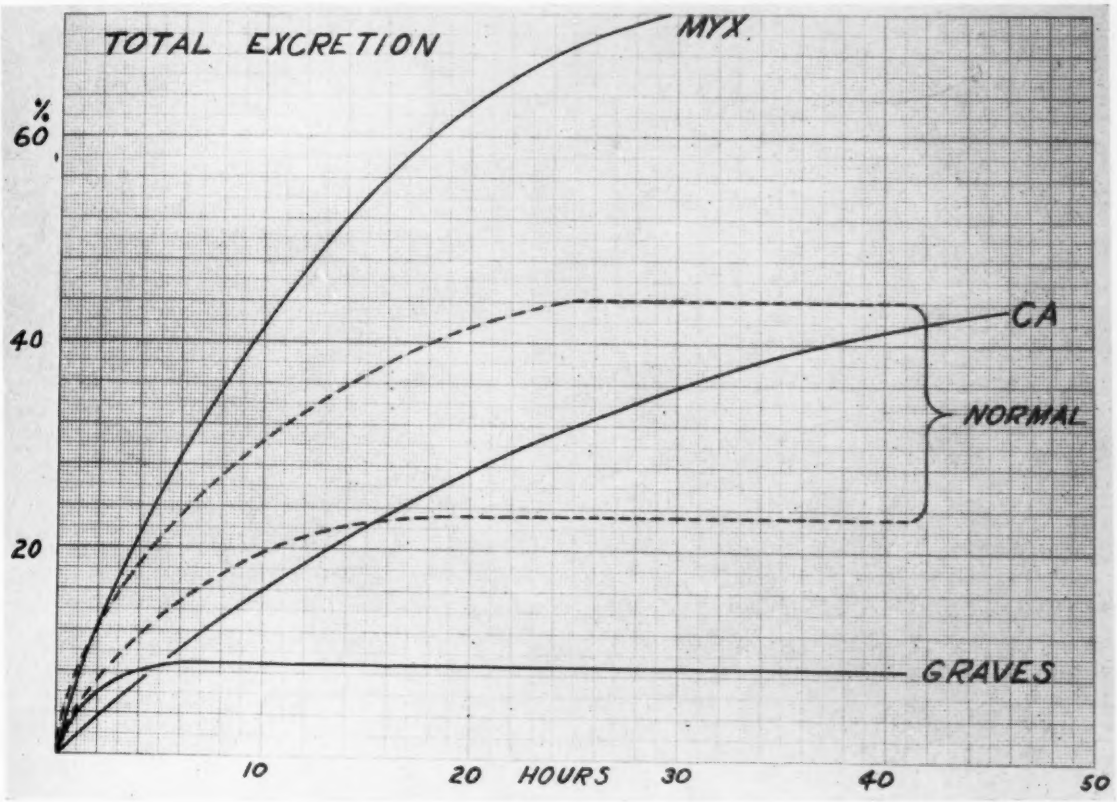

Fig. 5. Composite excretion curve.

before the Radiological Society in 1947[4]) or occult edema is present.[3] In this way an adequate tracer often gives the clinician valuable information, even where the thyroid status proves to be of very minor importance.

During the period when the counts are being made on the patient, the urinary excretion is also collected. Each individual sample of urine is tagged with the patient's name, the date and the exact time of voiding. Later these are analyzed in the isotope laboratory and an excretion curve is drawn. In the final analysis, 100 per cent of the to account for perspiration and the inescapable losses, including normal tissue retention. Significant deviations from this accounting are very rare but, when they do occur, steps are taken immediately to find the loss. Almost invariably the loss can be accounted for on the basis of vomiting, diarrhea, or lost urine specimens.

On one occasion failure of the final figures to render å complete accounting led to the discovery of deep abdominal metastases which previously had not been suspected. In another case the patient was found to have hydronephrosis with ureteral obstruc-

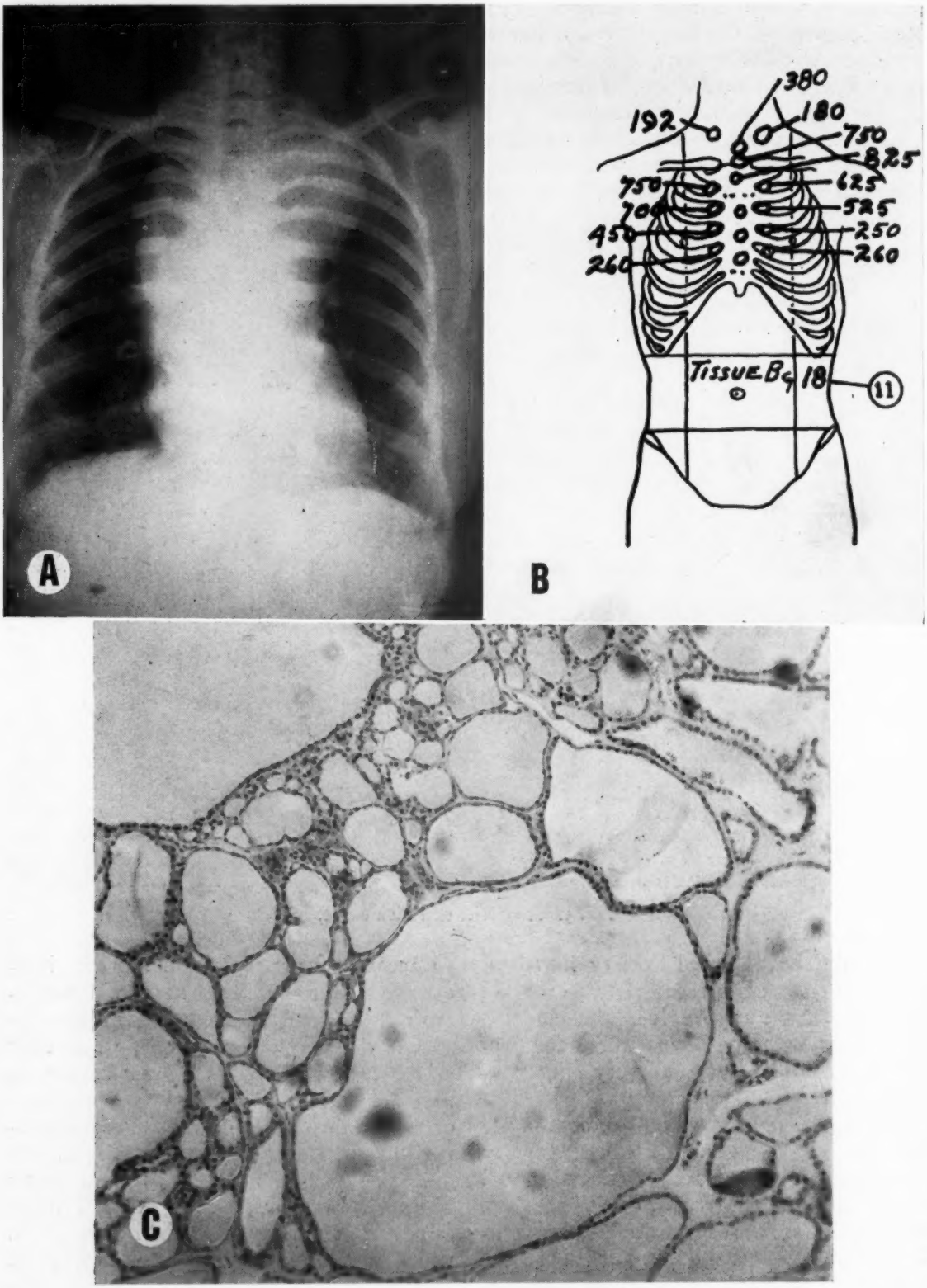

FIG. 6. (*A*) Roentgenogram reveals large unidentifiable mass. (*B*) Geiger counter map. (*C*) Microscopic section of tissue.

tion. It is of fundamental significance that neither an uptake nor an excretion study is a complete study and that the only reliable tracer technique is to utilize both and check one against the other.

The excretion curve (Fig. 5) is also of extreme importance. The total quantity excreted by the normal will be found to have a significant variation not only geographically but with the institution reporting.[6,9,11,13,14] In Michigan our population is somewhat iodine starved in spite of the general use of iodized salt and a person who from all clinical and other possible observations is perfectly normal may excrete as little as 24 per cent of the tracer. The same person, a normal, studied repeatedly over a period of time will give fairly large variations in total excretion, depending on his diet, physical activity, and general state of health at the time studied. It is therefore not possible to be dogmatic about the total excretion and, in fact, the normal range is wide and overlaps both the hyperactive and hypoactive states at its margins.

Roughly, we have found that a total excretion anywhere between 24 per cent and 44 per cent of the administered carrier-free dose may be entirely normal and any one patient may vary widely within this range. The total excretion is a direct index of the total thyroid function. The fact, however, that a patient's total excretion falls in the normal range is not necessarily evidence of a normal thyroid state. As we will show farther on, it can mean that the patient's total thyroid function is depressed by the presence of a toxic adenoma and a patient with a perfectly normal total uptake and total excretion can still be significantly unwell.

The shape of the excretion curve is of great importance in all types of abnormalities. In myxedema, naturally, the total excretion is high and, if this state is accompanied by a significant amount of real tissue edema, the curve may approximate a straight line for the first thirty hours and rise from the origin at an angle of about 45°, or even less. If no tissue edema is present to trap a part of the tracer, the rise will be faster and the curve will flatten out due to rapid depletion of the tracer substance.

In the extreme states of toxic hyperactivity, the curve may level off at 4 per cent or less, and Graves' disease in general, if it is clinically detectable, will give less than 20 per cent total urinary excretion.

The malignancies form a class by themselves, and, as previously stated, will be the subject of a separate presentation. In general, their detection is quite complicated due to the fact that a large quantity of normal thyroid tissue may exist in the presence of malignancy, and consequently a tracer having nothing but malignant characteristics is rare. The fact that these cases can be solved, however, is evidenced in our series by the fact that in 70 cases where a tracer diagnosis of malignancy was stated prior to operation, or postmortem, we have been wrong a total of 3 times and have 2 quibbles, for a net error on this one phase of the subject of 7 per cent.

In the course of the last three years twenty-six physicians—nineteen residents, three National Research Council Fellows including one National Research Council Fellow of Canada, and four fully accredited radiologists from cities remote from Detroit—have been trained to do this work and have done it successfully after leaving Harper Hospital.

A few illustrative diagnostic problems, each one representing a statistically significant number, can be used to illustrate the value of detailed tracer technique. Figure *6A* is a roentgenogram showing an unusually large and relatively unidentifiable mass. Several clinical diagnoses were made.

The patient was given 50 microcuries of radioactive iodine (I^{131}) as a tracer dose and the tracer map (Fig. *6B*) shows that this mass contained small islands of active thyroid tissue scattered throughout its bulk and was undoubtedly of thyroid origin. As the result of the tracer study, the patient came to operation whereas previously she

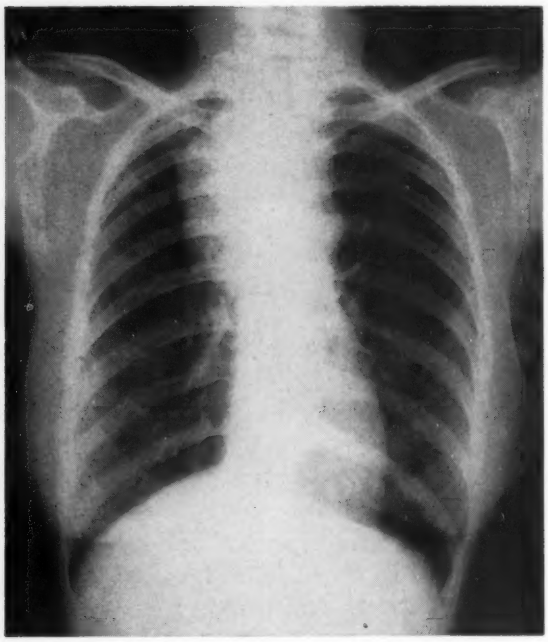

FIG. 7. Roentgenogram demonstrates shadow which was shown by tracer technique to be not of thyroid origin.

had been suspected of a lymphomatous disease and operation had been contraindicated. Figure 6*C* shows the type of tissue discovered, proving the tracer findings.

The next case (Fig. 7) illustrates a shadow which might well be a retrosternal thyroid but was shown to have no radioactive isotope uptake (either I^{131} or P^{32}). This case was shown by tracer technique to be not of thyroid origin and at operation proved to be a dermoid cyst.

Figure 8*A* illustrates the most critical type of case that can be attacked by this method. The lesion is in such a position that the diagnosis of thyroid tumor is greatly in doubt. Operative procedure was dubious because of the patient's age and physical condition, yet the mass was more than she could tolerate. Tracer technique showed this tumor to be of thyroid origin, containing islands of activity in a relatively nonfunctioning mass, and without characteristics of malignancy. The patient was operated on with complete relief of symptoms and is still alive and well after three years. The gross specimen is shown in Figure 8*B*. The tracer diagnosis was completely confirmed by histopathological examination.

The next case illustrates the example of a patient without thyroid in the normal region, having had a thyroidectomy some twenty years previously. She now appears with a high degree of thyroid toxicity with thyrotoxic heart disease. The roentgenogram of the chest was negative. Tracer ob-

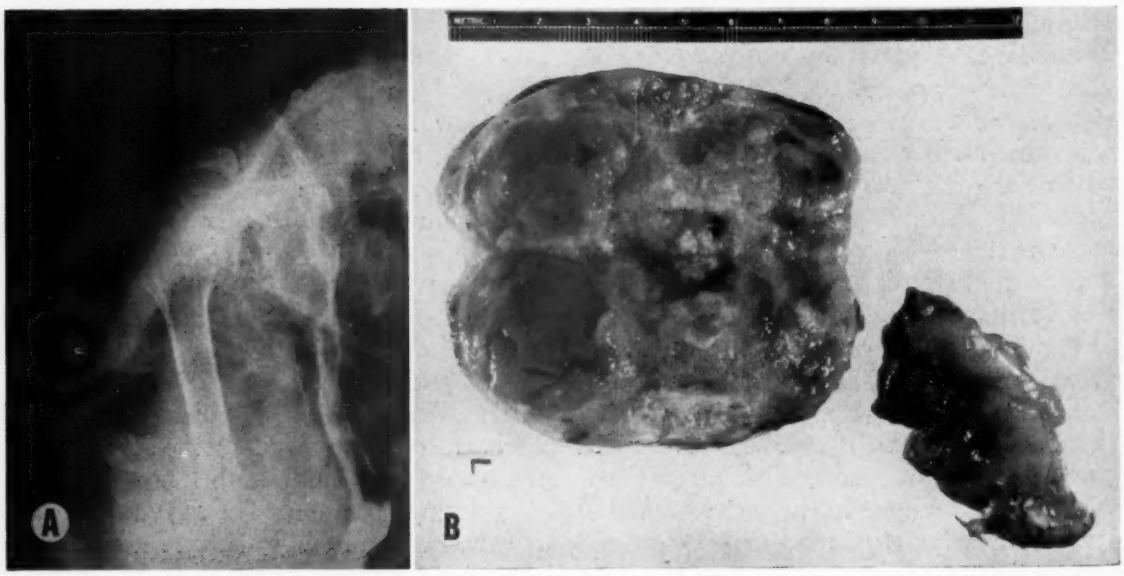

FIG. 8. (*A*) Roentgenogram demonstrates tumor mass. (*B*) Gross specimen of mass.

servation showed the presence of a concealed toxic retrosternal recurrence, which in this case was removed surgically and is shown in Figure 9. This patient also recovered completely and is still alive and well at the end of nearly four years.

Since that time these concealed toxic recurrences have proved to be so completely amenable to isotope therapy that relatively few of them are operated upon, although several are discovered and treated each year.

Two of the most satisfying types of cases that can be discovered and brought to treatment by the tracer technique are the concealed toxic adenoma and the patient who, due to thyroid toxicity or obstruction, has repeatedly been diagnosed as psychoneurotic.

An example is shown in Figure 10*A*. Only the excretion curve and the tracer map are presented, since all other types of observation were negative. The patient presented an incomplete clinical picture of thyrotoxicosis and for this reason her physician sent her for tracer study. The isotope tracer demonstrated beyond question that the patient had a concealed toxic adenoma in a gland of normal size and normal total function. The patient was brought to surgery to be explored for the toxic adenoma which had not been demonstrated by any other means. The histological section (Fig. 10*B*) shows a border of the adenoma and a small margin of the normal tissue.

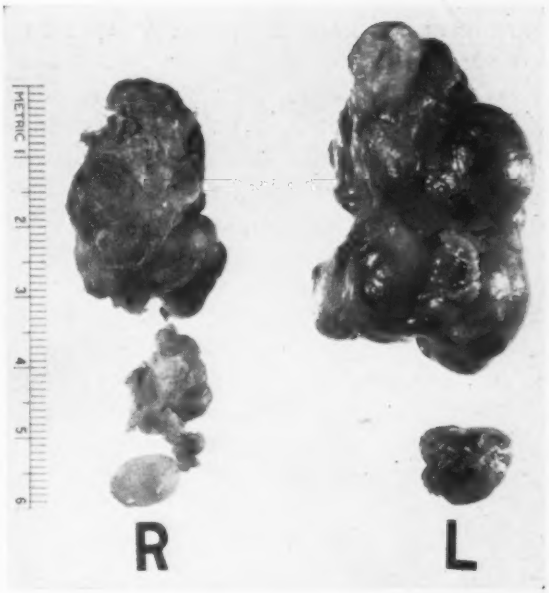

Fig. 9. Gross specimen of concealed toxic retrosternal thyroid recurrence revealed by tracer technique.

Since that time this type of case has been treated almost exclusively with the radioisotope. The differential absorption between the toxic adenoma and the normal tissue is extremely high and, after destruction of the adenoma, the gland returns to a normal state of function. It may be of special interest that 3 of these cases whose chief complaint was inability to become preg-

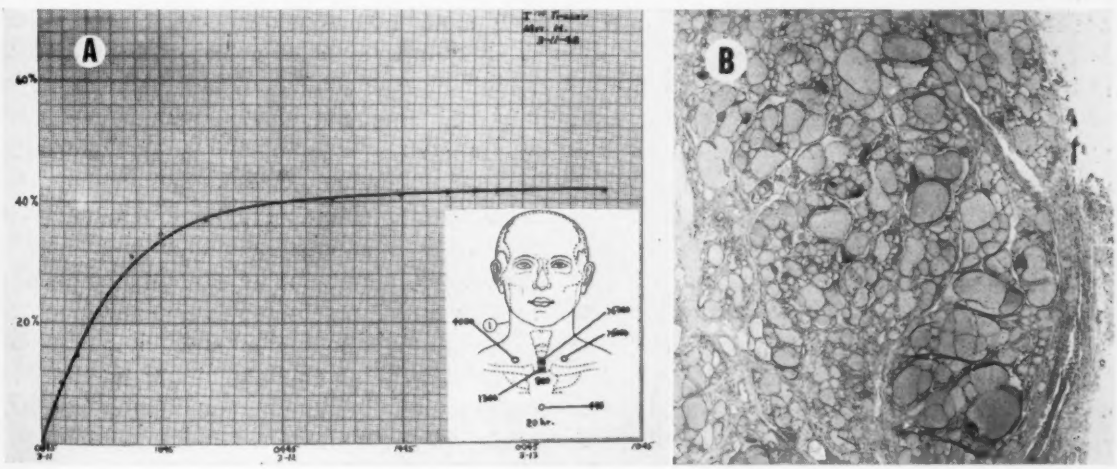

Fig. 10. (*A*) Excretion curve and tracer map. (*B*) Histological section.

nant have had normal births subsequent to isotope therapy.

A single example of a psychoneurotic was kindly supplied to us by Drs. Holly, Joistad and Emerick of Muskegon, Michigan. This patient could not breathe and could not swallow anything other than liquids. She had been to three of the great medical centers in the United States and had a diagnosis of "psychoneurosis" at each of them. The radiologist suspected but could not prove that a real lesion existed and asked for a tracer study.

Very careful detailed roentgenograms were completely negative and other types of examination were also inconclusive. The tracer map (Fig. 11*A*), however, promptly showed the existence of thyroid recurrence behind the end of the right clavicle, impinging on both the trachea and the esophagus. This mass (Fig. 11*B*) was removed by Dr. Normal Fleischman of Muskegon with subsequent complete recovery of the patient.

Where pressure symptoms are not the main consideration, this type of case is also immediately and most amenable to isotope therapy, and a large number of persons with presenting diagnosis of either "psychoneurosis" or "hysteria state" have been treated successfully. The isotope therapy, of course, is of little use against pressure-producing masses, although it is sometimes used to reduce the patient's thyrotoxicity to a level acceptable to the surgeon who then removes the mass.

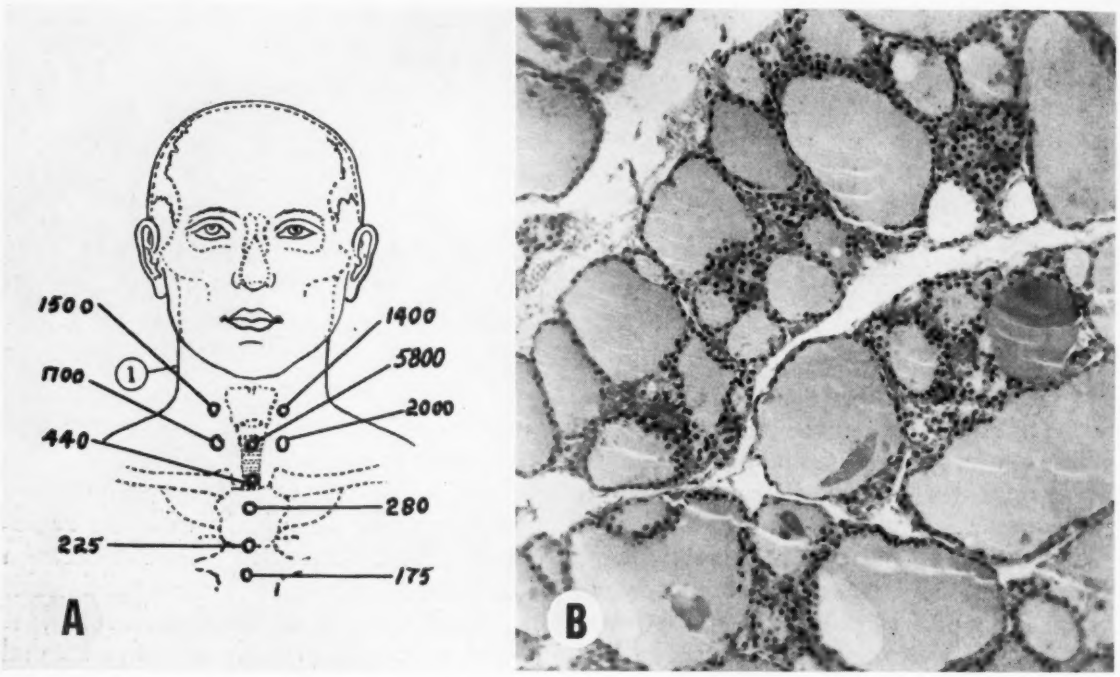

FIG. 11. (*A*) Geiger counter map of "psychoneurotic" patient. (*B*) Microscopic section of tissue.

It should also be noted that a negative result from a tracer study is of value in this type of case. One example in our experience was that of a woman with an extremely elevated basal metabolic rate and other gross evidence of thyrotoxicosis who gave a perfectly normal tracer finding. Her difficulties subsequently were proved to be due to the presence of an adrenal tumor. Such a negative finding, however, should never be accepted without the most careful and detailed study for the purpose of detecting possible concealed toxic adenomas.

Only one example of carcinoma will be given and the sole purpose in including

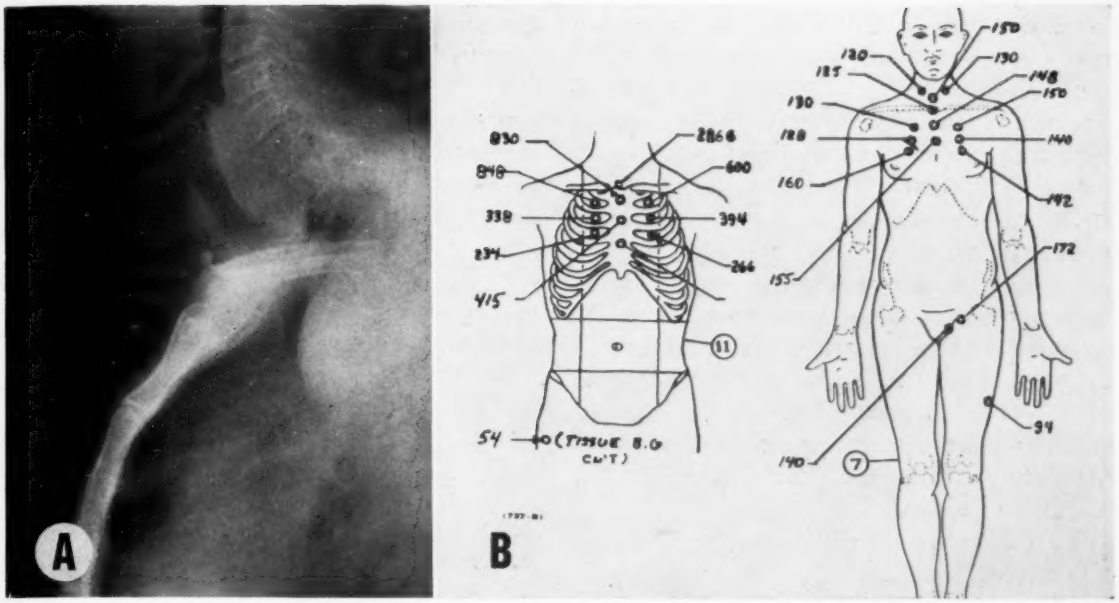

Fig. 12. (*A*) Roentgenogram of chest appears clear but (*B*) Geiger counter map demonstrates peritracheal invasion.

it is to illustrate the fact that in many cases the tracer technique will demonstrate otherwise unsuspected metastases. The roentgenogram of the chest (Fig. 12*A*) appears perfectly clear but a tracer map (Fig. 12*B*) shows that there is peritracheal invasion. Six months later additional roentgenograms showed the development of these metastases to a mass which could be demonstrated by ordinary roentgenological means. This type of case will be discussed in detail subsequently.

In all of the examples, we have dealt with the use of radioiodine in simple inorganic form but eventually this may prove to be the least important of the many things that can be done with the radioisotopes. A single example of a more complex procedure is a case we studied in May, 1948, and which has been the prototype of a number of studies since.

This patient had a carcinoma of the small intestine with a pancreatic fistula. Twelve to fourteen hundred milliliters of fluid were draining from the fistula in each twenty-four hour period and, therefore, it was suspected that the fistula extended either into the small intestine or the thoracic duct. To attack this problem, the apparatus shown in Figure 13 was blown and

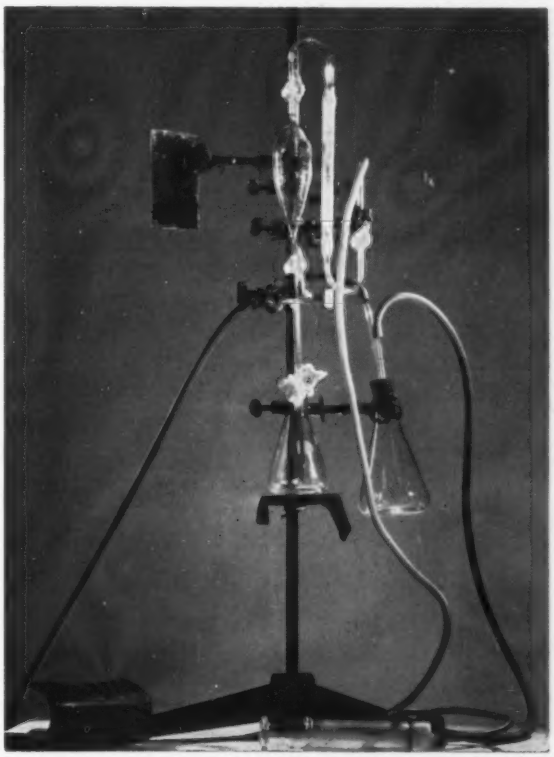

Fig. 13. Remote control iodination apparatus (shown outside of shielding).

a small quantity of olive oil was iodinated, using I^{131} with some added carrier. Since the total quantity of iodine added was chemically negligible, the physiological properties of the oil remained unchanged. The oil was then fed to the patient and the radioactivity accounted for in the usual manner. None of it appeared in the drainage from the fistula but it did appear in the thyroid and in the urine, demonstrating that there was no communication between the fistula and either the intestine or the thoracic duct, and further demonstrating that the patient was capable of digesting edible oil. Subsequently the fistula was closed.

This case illustrates the vast array of fundamental physiological and diagnostic problems that can be attacked by the tracer method.

SUMMARY

In summary, we can say that the use of the radioactive tracer as a simple substitute for the basal metabolism has rather marked limitations, the worst limitation being that it will fall prey to some of the same errors. Trained clinicians can diagnose well over 90 per cent of all thyroid disease without specialized laboratory aid. The great field for the use of the isotope tracer, aside from malignancy, is in those cases which present mixed symptoms or, presenting serious symptoms, show nothing on standard clinical and roentgenological examination.

The detection and subsequent control of the serious thyrotoxic cardiacs, the uncontrollable diabetics who are being driven by thyroid toxicity, and many other seriously ill patients whose fundamental disease process cannot be elicited by any other means, is one of the most scientifically profitable and humanly satisfying experiences that one can enjoy. The tremendous power of the tracer technique for this type of work in a well controlled department of radiology has not been appreciated by radiologists who have, unfortunately in some cases, allowed it to pass from their supervision into departments where it cannot be appreciated or properly used. It is sincerely to be hoped that roentgen diagnosticians will appreciate and utilize this excellent and powerful auxiliary to their standard techniques which now lies easily within their grasp.

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DISCUSSION

Dr. Theodore P. Eberhard, Philadelphia, Pa. I must first express my deep regret that I was unable to hear this excellent paper and see the slides which undoubtedly added much to the text.

This audience, however, may not fully realize the full significance of the low error rate of 1 per cent since they did not see the imposing list of differential diagnoses successfully established by the authors. Some twenty-four conditions arising from the thyroid or simulating thyroid disease were studied, sixteen of them in individual series large enough to eliminate the element of chance. Such accuracy is, of course, the result of the extreme care, the exhaustive series of determinations, and the meticulous attention to detail exercised by the authors. They have set a standard which all of us would do well to emulate.

Still, one is apt to get the feeling from the paper that I^{131} diagnostic work cannot be of value unless all of this technique is carried out in every patient, something which is obviously far beyond the reach of most of us. Total urine collections can only be done with reliable consistency with the patient in a special metabolic or investigative ward. Assay of urine samples is not a simple ward laboratory procedure. Determinations on the patient at least five times in thirty-two hours require not only hospitalization but a fairly large staff doing little else but this work. I am glad that somebody can command so many hospital beds so easily. In our experience, this elaborate ritual is necessary only in the occasional problem case. As the authors state, 90 per cent of thyroid disease needs no iodine determinations and such investigation is at no time a substitute for careful clinical evaluation and a properly controlled basal metabolism. The results already published by so many competent investigators have established certain standards which make it no longer necessary for the routine clinical worker to gather all of the data mentioned in this paper on every case. An answer to the one or two questions which make the radioiodine determination necessary can be obtained in most cases by simpler techniques well within the reach of all of us. In our experience, the clinically necessary data can almost always be obtained from a single determination of the uptake at twenty to twenty-eight hours. The counting tube used should be at such a distance and of such a window diameter as to figuratively "see" all of the thyroid. Consistent, comparable results can only be obtained with reproducible geometry, and hence I believe that some device which will hold the tube in a fixed position at a fixed distance from the immobile patient is a necessity. This technique will ordinarily give the differential diagnostic confirmation desired and some idea in the hyperthyroid cases of the proper therapeutic dosage. It is admitted that this technique is subject to at least a 10 per cent error either way, but even the authors admit that they allow themselves 10 per cent undetermined residue.

The serious problems of the presence or absence of significant tissue retention outside the thyroid, or the detection of small hidden foci of either benign or malignant thyroid tissue naturally requires the collimated, highly mobile type of tube holder described, and the plotting of absorption and excretion curves. I am surprised that no mention was made of determinations of the thyroxin and diiodotyrosine fractions from blood samples, probably a more significant factor in the differentiation of certain types of thyroid disease than the curves presented here.

The use of the isotope to determine the type of pancreatic fistula is a beautiful example of the uses that intelligence and imagination can make of this and other radioelements. And I agree with the authors that radiologists have been missing the boat in many places. Usually

they are the only persons with initial knowledge of radiophysics and hence are the logical ones to pick this thing up and master it before we lose it completely to untrained practitioners in other fields.

DR. CORRIGAN (closing). In answer to Dr. Eberhard's discussion, I would like to add that he has given a beautiful analysis of our paper and of the more fundamental ideas which are not specifically stated in the paper, particularly his last paragraph in which he points out the necessity for radiologists to add this "new" technique, which is actually a form of radiology, to their regular standard procedures. We have been advocating this very thing for a full ten years and are still strongly advocating it.

With regard to some specific points in the discussion, the "large staff doing little else but this work" at our institution consists of two people who do a great deal besides this work.

We are in complete agreement with his statement that a fixed distance Geiger counter is necessary for therapy cases. The diagnostic procedure, however, is intended for those cases not amenable to diagnosis by ordinary clinical or roentgenological means—the real problem cases. These only are the subject of our presentation.

With regard to further blood chemistry, we have found it considerably less helpful, although as Dr. Eberhard may have noticed, we have some original publications, particularly on precision determination of protein-bound and inorganic blood iodine. Our experience has been that chemical determinations are only of real value where chemical block is suspected.

The relation of Dr. Eberhard's "10 per cent error either way" to our undetermined residue of 10 per cent is a clever non sequitur.

In general, I would like to thank Dr. Eberhard for a scientifically valid and entirely courteous discussion of our paper.

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ROTATIONAL SCANNING OF BREAST MALIGNANCIES WITH SUPERVOLTAGE RADIATION*

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1. INTRODUCTION

THE absolute five year survival rate for patients with primary carcinoma of the breast reaching large general hospitals is in the region of 30 to 40 per cent. When the radical operation is the main method of treatment, supplemented by roentgen therapy in some centers, typically some 70 per cent of the primary cases are operable,[10,15,24,28] and about 50 per cent of these patients survive five years.[1,10,15,17,24,28] Perhaps the most reliable, and incidentally one of the highest, figures for the five year salvage of all cases occurring (that is, with no selection) in a large region (southeastern Scotland) is that given by McWhirter, through whose hands pass 90 per cent of the cases of breast cancer in that region, including terminal cases. His latest survival rate is 41 per cent.[15]

It has been shown that roentgen therapy can play an important part in increasing this low survival rate from two aspects. On the one hand, there is scope for prophylactic treatment of patients inoperable by conventional criteria (for example, those of Haagensen[10]), provided they do not exhibit metastases beyond the immediate lymphatic drainage region.[3,15] Some of these cases may indeed be rendered operable.[21] On the other hand, radiation may be used as an adjunct to surgery in conventionally operable cases. Statistics here have demonstrated a 5 to 10 per cent increase in survival from the radical operation when routine irradiation has been used to tumor dose levels not exceeding 3,000[1,12,17] in twenty-one days. McWhirter, using irradiation of the axilla instead of surgery, has shown a 10 per cent increase in the five year survival rate. Berven[5] has shown that if large axillary masses exist, preoperative irradiation increases survival from 7 per cent to 32 per cent with a tumor dose of 2,000 r in ten days.

It is recognized, then, that the main cause of the failures of surgery is the extension of the disease beyond the field of even the most radical operation, and that irradiation, particularly of the axilla, can reduce the number of failures. The failures of irradiation, other than those resulting from the occurrence of distant metastases before or during treatment, may be attributed to the fact that too low a tumor dose was given, too limited a region was treated, or both. If radiation is to increase survival rates further, we must consider both the region to be treated routinely and the dose level at which to aim. The purpose of this paper is to outline these requirements and then to show how, by using 2 million volt radiation and a rotational method of delivery, these requirements may largely be met.

2. TREATMENT REGION

It is widely recognized that in carcinoma of the breast there is a high probability of extension into the surrounding lymphatics even when this is not obvious clinically; that is, there are no palpable lymph nodes. Even in Stage 1 cases in which an early tumor is apparently localized in the breast, the radical operation fails in about 20 per cent of the cases.[1,7,10,

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[12,15,17,20,24,28] In the 60 per cent of operable cases which have obvious axillary involvement, radical operation[1,5,7,10,12,15,17,20,24,28] fails 60 per cent of the time. Moreover, it is certain that the prognosis is much worse for lesions situated in the inner hemisphere; that is, in 30 per cent of the occurrences, as exemplified by the figures of Bartlett.[4] With no lymph node involvement, his ten year cure rate was 77 per cent for lesions in the outer hemisphere and only 47 per cent for lesions of the inner hemisphere. With lymph node involvement, the figures fell to 29 per cent and 4 per cent, respectively. Similarly, Hare recently reported a three year survival of 46 per cent for outer lesions and only 18 per cent for inner lesions.

Some explanation of these results is afforded by the recent work of Saner[21] and his colleagues on the subject of lymphatic spread. Sixty-five consecutive, early cases were studied by W. S. Handley in which biopsy of the second intercostal lymph node of the internal mammary chain and of the axilla was made. One in 3 cases showed mediastinal invasion and 2 in 3 showed axillary invasion, while 2 in 3 cases in which the primary tumor was in the inner hemisphere showed mediastinal involvement. To quote Saner, "The internal mammary chain is often invaded at the same time as the axilla and sometimes before it." The internal mammary chain and the associated deep fascial nodes of the chest wall are effectively inoperable. Hence any scheme of routine radiotherapy should include not only the axilla but also the chest wall and the mediastinum. A similar argument would justify the inclusion of the supraclavicular triangle.

3. DOSE LEVEL

The work of Lenz[14] has shown that a tumor dose of 4,400 r delivered in two months is insufficient to destroy carcinoma in the breast, as determined by pathologic examination. A tumor dose of 6,000 to 8,000 r given in three to three and a half months has produced clinical cure for ten years in 30 per cent of another series. Baclesse[3] reported that clinical cure becomes more frequent when tumor doses of 6,000 r or greater are delivered in three months. Williams and Cunningham[27] found that a tumor dose of 3,000 to 3,250 r to the breast in twenty-eight days in 9 cases caused pathologic disappearance of growth in 1 case, while 4,000 r to the axilla caused disappearance in 5 cases. To these observations we may apply the fractionation data of Strandqvist[23] and deduce that 4,000 r in a treatment time of forty days is an insufficient dose and that cure becomes more and more likely as 4,900 r is exceeded. This may be compared with Strandqvist's data giving 6,400 r in forty days as the minimum tumor dose for cure of epidermoid carcinoma. We may conclude that there is a high probability of cure of breast cancer with a tumor dose of 6,000 r delivered in forty days.

It is considered unwise to operate in the breast field after the delivery of 6,000 r to the large volume of tissue indicated. Therefore, the radical treatment to be described is normally applicable to inoperable cases, to operable cases postoperatively, and to recurrences in the immediate region of the breast.

4. FURTHER DESIRABLE FEATURES OF RADICAL THERAPY

(a) The treatment should avoid post-irradiation injury to the skin and to the lungs by the production of pneumonitis, as far as possible.

(b) The dose distribution over the whole of the irregularly shaped volume indicated in Section 2 should be as uniform as possible.

(c) The treatment regimen should be as standardized as possible.

5. PREVIOUS WORK

Attempts at prophylactic treatment heretofore have rarely covered such an extensive region. Usually, treatment has been confined to the breast proper, the axilla and supraclavicular region being in-

cluded if they showed demonstrable metastases. A few workers have included the latter regions routinely in more advanced cases, but in general the mediastinal nodes have not been treated.

The breast has, in general, received treatment by the tangential method with two, three or four portals—two portals, medial and lateral, almost opposing, and the other portals, if any, being superior and inferior. The axilla has, in general, received treatment by from one to four portals—the single portal is inevitably a direct oblique anterior portal, while the others may be anterior, posterior and superior (through the supraclavicular and shoulder regions). Supervoltage roentgen therapy also (Phillips[19] with 1 mev., and Buschke, Cantril and Parker[6] with 800 kv.) has been of the tangential crossfire type to the breast proper, possibly including the anterior axilla, or with a single portal direct to the axilla. With the comparatively low doses and non-uniform distributions obtained by usual treatments, together with the failure to treat the potential lymphatic spread, it is not surprising that roentgen therapy of the breast has been relatively unsuccessful in curing cancer.

Perhaps the most thorough radiation therapy in this field has been performed by the late Gordon Richards and by F. Baclesse. Both of these workers show unusually high survival rates for advanced cases. Richards' statistics for Stages II, III and IV treated preoperatively at 400 kv. with 3,500 r tumor dose in three weeks show 46.0 per cent five year survivals,[20] while Baclesse[3] with preoperative irradiation at only 180 kv. has rendered 46.7 per cent of Stage II and III cases clinically free after five years, and using irradiation only with a dose of at least 6,000 r in three months has secured a three year cure rate of 31.6 per cent for Stages II, III and IV. In both of these treatment regimens six, seven or more portals have been used to cover the region of the breast and the surrounding lymphatics, actually or potentially involved, although even here, in general, the internal mammary chain has not been adequately treated. Indeed, it is difficult to see how these lymph nodes can be completely treated without treating part of the lung by a tangential crossfire technique for the breast.

6. Advantages of a Two Million Volt Technique

In those previous cases in which a cancerocidal dose has been attempted by the delivery of tumor doses equivalent to 6,000 r in forty days, there has been extensive skin damage. For example, Buschke, Cantril and Parker,[6] with a relatively favorable beam quality (800 kv.) using opposing portals to the breast, inevitably produced a moist desquamation over most of the breast before this tumor dose was achieved. An increase in voltage from 800 kv. to 2,000 kv. may be expected to produce an appreciable increase in skin tolerance, owing to the subcutaneous and other effects.[8,9,22] For single direct portals an increase of erythema dose by a factor of 2 and for opposing portals an increase by about 1.5 may be expected. A further advantage of 2,000 kv. radiation in the location of the breast is the reduction of dose to neighboring organs such as the lung, and hence of total volume dose for a given tumor dose. This effect is due to the reduced scattering of the higher quality radiation. These benfits are still more marked when contrasted with conventional 200 kv. radiation.

7. Advantages of a Scanning Technique

The skin-favoring properties of 2 million volt radiation are emphasized by the use of the scanning technique to be described, for during this treatment much of the skin is subjected to an inwardly directed beam as distinct from an exit beam. The major advantage of the scanning technique *per se*, however, is the ability to deliver a substantially uniform dose over a region extending from the axilla to the mediasti num bounded by the pleura on the inside

and the subcutaneous tissues on the outside, using only two treatment fields.

8. ANATOMICAL AND GEOMETRICAL CONSIDERATIONS

The region to be treated will be seen to circumscribe the lung from the deep mediastinal nodes anteriorly through the breast around to the posterior axillary fold, rising then superior to the lung to include the supraclavicular triangle and possibly the side of the neck and cervical regions.

With the patient in a sitting position so that trunk is vertical, at any given level between the diaphragm and the clavicle the region to be treated lies outside of and anterior to a circle which can be drawn more or less coincident with the lung boundaries. The region is also limited by two radial vertical planes about 180 degrees apart. This is illustrated in Figure 1*a* for a horizontal section at the level of the nipple. As the level rises, the circle which approximates the lung area will become smaller, but all the circles may be drawn about a single vertical axis. Geometrically, in fact,

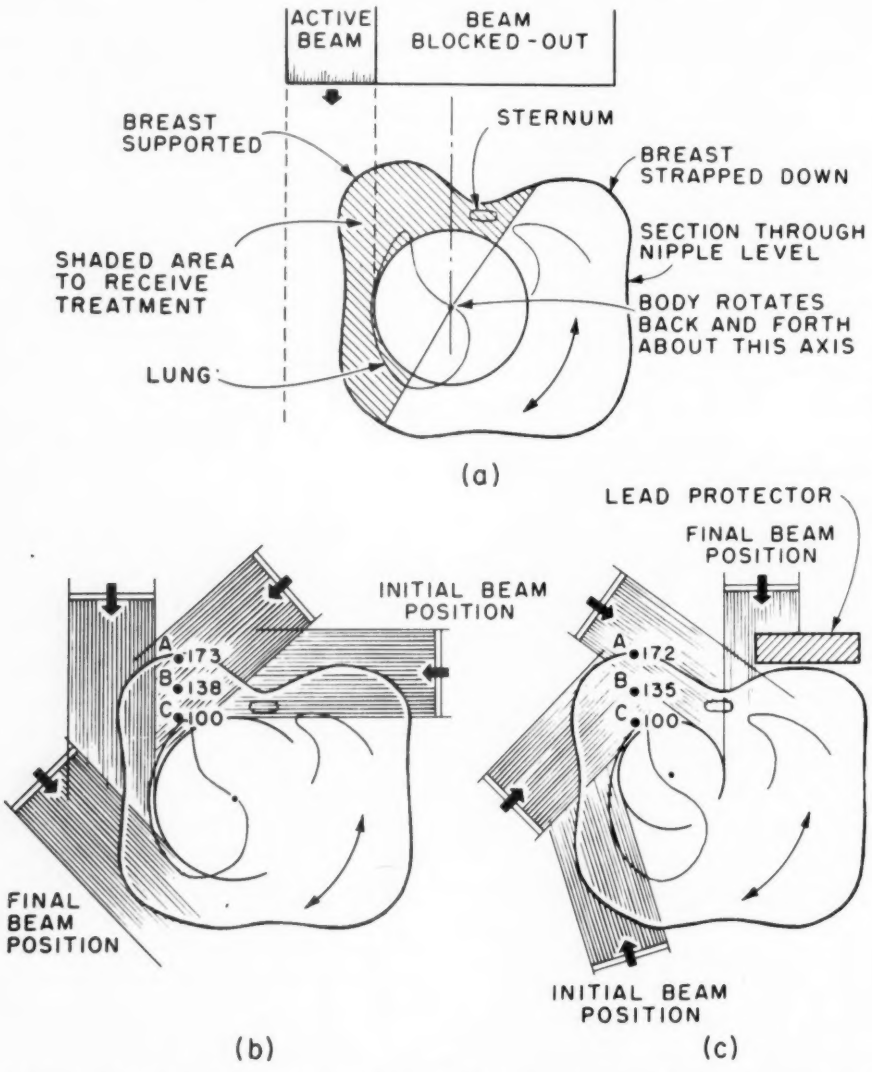

FIG. 1. (*a*) Principle of partial rotation method. (*b*) Type A rotation. (*c*) Type B rotation showing several relative positions between beam and patient.

the lung may be simplified into a paraboloid.

This observation suggested a partial rotation or "sector scan" of the patient during treatment. Imagine the patient to rotate about this fixed vertical axis through the lung and a horizontal roentgen-ray beam whose midline passes through this axis to be directed at the body. Suppose the portal size is 20 by 20 cm. Now, let all this beam be blocked out by a suitable absorber except the outermost strip, perhaps 5 by 20 cm., which lies outside the lung profile. Then if the body rotates back and forth through a suitable angle, only the outer body envelope will be irradiated, as is desired, and the lung will not receive any dose at all. This is illustrated in Figure 1*b* which shows several positions of the active beam relative to the body. The effect of such treatment is to wrap a band of ionization around the lung from the mediastinum to the axilla.

Two Methods of Rotation. There are obviously two ways in which such a partial rotation treatment can be delivered, as illustrated in Figure 1*b* and *c*. In one case, Type A, the beam enters medially and anteriorly and progresses to a postaxillary portal laterally; and in the other case, Type B, it enters as a postaxillary portal posteriorly and progresses to a mediastinal portal anteriorly.

9. TREATMENT FACTORS

Throughout these treatments, the physical factors are: 2 mev. radiation; half-value layer 12 mm. Cu; output 70 rpm in air at 1 meter or 47 rpm at 125 cm.; target-axis distance 125 cm.; rotation speed about 1 revolution per minute.

10. RADIAL DOSE VARIATION

With either of these techniques it is apparent that the tissues irradiated receive large dosage variations. Consider, for example, the relative doses delivered at three points *A*, *B* and *C* (Fig. 1) by either of the methods, assuming a beam of 2 mev. radiation uniform over its active width. In Figure 1*b* the relative doses are 173, 138, 100, while in Figure 1*c* they are 172, 135, 100. In order to equalize the dose at *A*, *B*, and *C* and over a wide arc of tissue surrounding the lung, it is necessary to vary the beam intensity over its width. For this purpose a "stepped" filter of copper has been used, hereafter referred to as the "radial" filter. Figure 2*a* and *b* shows the relative dose calculated at a number of points for the same treatments as are illustrated in Figure 1*b* and *c* but with the addition of the radial filters of the design and location indicated.

11. VERTICAL DOSE VARIATION

For higher or lower body sections in which more or less of the beam width is blocked out, the relative dose distribution at points located similarly to those in Figure 2*a* and *b* will be different, but a compromise filter design will produce approximate equality through the tissue over a wide area in any section. The dose, as a whole, received by these other sections, however, will be lower or higher, depending on whether the body section as a whole contains more or less tissue. In general, therefore, using the compromise radial filter only, doses throughout a section passing through the armpit, for example, will be higher than doses throughout a section passing through the nipple. This inequality may be approximately corrected by the addition of a stepped filter in the vertical sense, as indicated in Figure 3.

We can now consider dosage distribution differences arising between rotation treatment of Type A or Type B.

12. DOSE DISTRIBUTIONS

Type A. Despite these refinements already discussed, it is clear from the calculated dose distribution of Figure 2*a* and the photographically[11,26] obtained (Fig. 5) isodose curves of Figure 4*a* that partial rotation of Type A is not alone satisfactory. In particular, the dose in the mediastinal nodes and in the medial half of the breast is too low. There are several methods

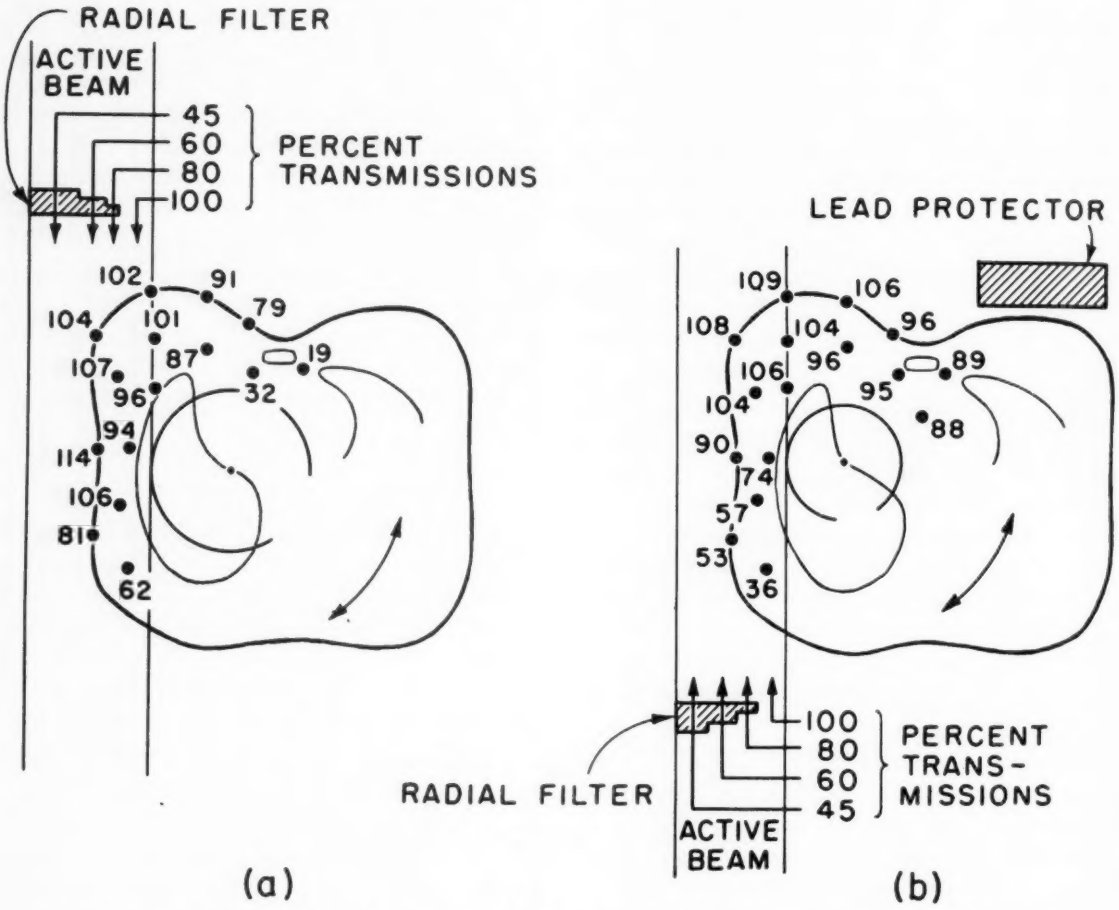

FIG. 2. Calculated dose distributions for (*a*) Type A and (*b*) Type B rotations with radial filters.

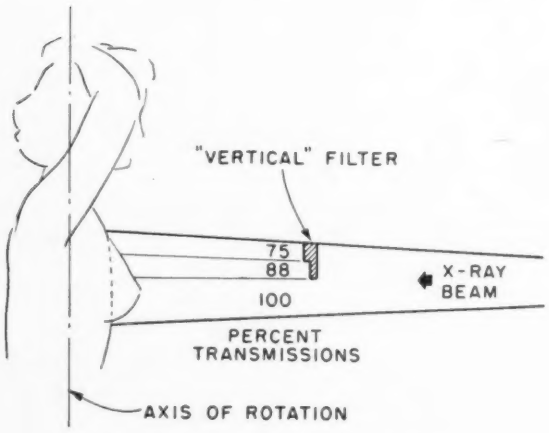

FIG. 3. Positioning of vertical filter.

of supplementing the dose in this region, but generally we have used a further rotational treatment by which a "cylinder" of radiation is added to the mediastinum; that is, a field 7 cm. wide, extending from xyphoid to sternal notch and centered both anteriorly and laterally on the sternum is applied with complete rotation of the body. This field is illustrated in Figure 4*b* showing the photographically obtained isodose distribution. It has been used alone for treatment of sternal lesions. The net isodose distributions with the two rotation fields combined, with optimal dose allocated to each, are shown in Figure 4*c*. The distributions shown are for horizontal sections through the nipple level, but similar distributions obtain at higher and lower levels.

The disadvantages of this distribution lie in the hot spots which unavoidably occur where the two rotation fields overlap, and often in the anterior axilla, particularly at the armpit which is prone to des-

quamation. Nevertheless, this treatment regimen has been used successfully to give 6,000 r in forty days without necessarily reaching a moist erythema.

Type B. Consideration of the point doses of Figure 2*b* and the photographic isodoses of Figure 6*a* for a horizontal section through the nipple shows at once several advantages of Type B over Type A rotation. Again, of course, it is necessary to use both a radial and a vertical filter. Clearly, the dose received by the mediastinum is now eminently satisfactory from the partial rotation alone, while the breast and the anterior axilla are uniformly treated. The low dose region lies at the posterior axillary fold and farther posteriorly. The dose here may be simply and effectively increased by treating the patient with a single posterior portal in a stationary position at the angle at which the rotation commences, giving this portal a relatively low air dose. In general, the relative air doses given by the partial rotation and by the single posterior portal are in the ratio of 5 to 1. Using this technique, a tumor dose varying ±10 per cent over the potentially tumor-bearing volume surrounding the lung, as illustrated in Figure 6*b*, may be given. It is notable that the lung on the diseased side suffers little dose, while the other lung, although receiving some dose from the anterior approach, receives only some 20 per cent maximal tumor dose. It will be also observed that the deeper mediastinal nodes receive a substantial dose.

13. LUNG PROTECTION

In these radical treatments, it is desired to give a sterilizing dose to the lung wall

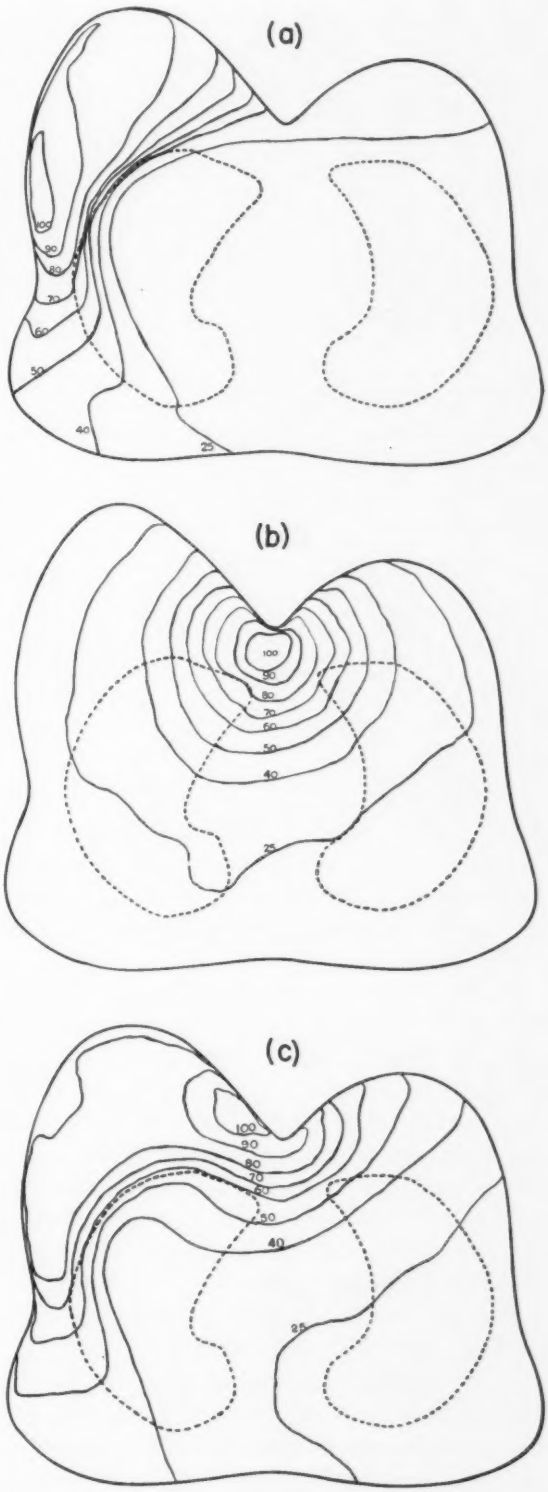

Fig. 4. Isodose distributions for Type A rotation at horizontal section through nipple level with 2 mev. radiation. (*a*) 135° rotation only; (*b*) sternal supplement only; (*c*) 135° rotation plus local sternum rotation. These distributions were obtained by sandwiching roentgen film in a sectionalized masonite female phantom with air cavities to simulate lung. For tissues of about unit density these distributions are ±10 per cent accurate, but for the lungs the doses indicated are too high due to the longer ranges of Compton electrons in air than in lung tissue.

FIG. 5. Distribution of blackening on film for Type B rotation with axillary supplement. Section at nipple level. Eastman Kodak Type A film. Ratio of air doses to rotation and axillary parts 5:1 with 2 mev. radiation. Isodose drawn for this film reproduced in Figure *6b*.

without appreciably irradiating the lung proper. Obviously, the rotation technique as described cannot produce a sharp edge to the irradiated region anywhere. But the radial filtration technique produces a "gradient" region extending radially some 2 cm., depending on the radius of the blocked field; that is, there is zero dose at the edge of the blocked field region, increasing over a distance of 2 cm. outward to maximal tumor dose. Hence, in setting up the patient for treatment, the active beam must "see" some 2 cm. of lung as it sweeps around the body profile. This peripheral region of the lung which is irradiated receives on the average only 50 per cent of tumor dose. Figure 7 shows a typical positioning roentgenogram of the treatment field relative to the pleura and the skin for the posteroanterior position of the body.

14. FIELD PROFILE

The above consideration of treating lung wall implies that the shape of the treatment field vertically must follow the lung profile, around the arc of treatment. To approximate to this in a large number of patients, the lead block arranged near the target to cut off three-quarters of the beam is shaped on the active side to something like a parabola. In order to obtain substantially the same profile to the anterior wall of the lung viewed laterally as to the outside wall of the lung viewed posteroanteriorly, the patient must be set up for treatment leaning forward slightly so that the chest wall is vertical. The uniformity of dose distribution will remain only tolerably uniform, moreover, if a minimal distance of about 3 cm. is maintained from the edge of the blocked region to the axis of rotation. This condition will obtain at the upper field margin where the lung has a small cross-section—at the level of the sternal notch (Fig. *6c*). Figure 8 illustrates the location and shape of the irradiating beam with respect to the body and particularly the lungs for three positions of the body during rotation of Type B. For Type A rotation the field shape re-

mains the same, but its location in these positions will, of course, be different.

15. TREATMENT OF THE SUPRACLAVICULAR TRIANGLE AND NECK NODES

Extension to Breast Field. Since the axis of rotation about which the breast rotational treatment is given passes up through the center of the supraclavicular triangle, or possibly in some patients slightly anterior to this, it is possible to treat both this region and the lymphatics of the neck, if this is desirable, as part of the rotational breast field. Calculation shows at once, however, that since this upper region would necessarily be continuously irradiated over the whole arc of treatment, it will receive a much heavier dose than the sternum-breast-axilla region. This could be remedied by using a heavy filter as part of the "vertical" filter to reduce beam intensity over this part of the field.

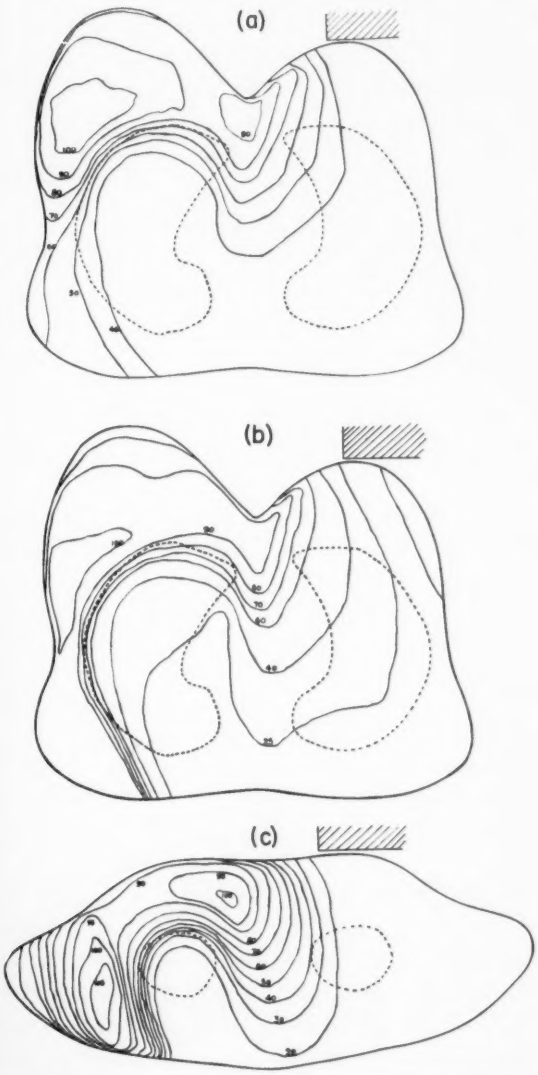

Fig. 6. Isodose distributions for Type B rotation with 2 mev. radiation. (*a*) 220° rotation alone—section at nipple level; (*b*) 220° rotation plus axillary supplement—section at nipple level; (*c*) 220° rotation plus axillary supplement—section at sternal notch.

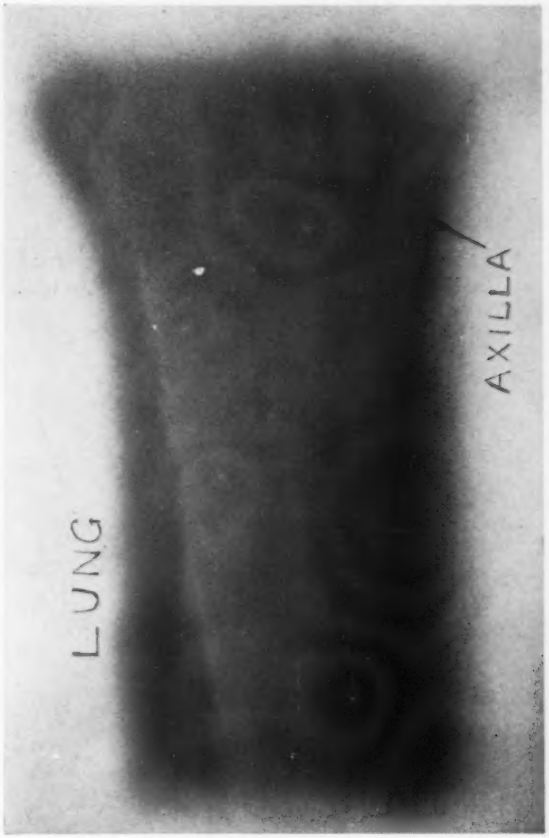

Fig. 7. Two million volt roentgenogram showing field position relative to lung profile. Type B rotation. Posteroanterior view. Blackening indicates field shape.

This type of treatment has been used, but in general it is more convenient to divide the region into two fields, one for the breast as described and one for the supraclavicular region. This avoids the risk of overtreatment or undertreatment at the apex of the lung owing to faulty position-

ing of the vertical filter, and facilitates the application of the single portal to the axilla.

Separate Treatment. In the separate treatment of the supraclavicular region, two fields have been used, the choice depending on whether one side or both sides of the neck require treatment.

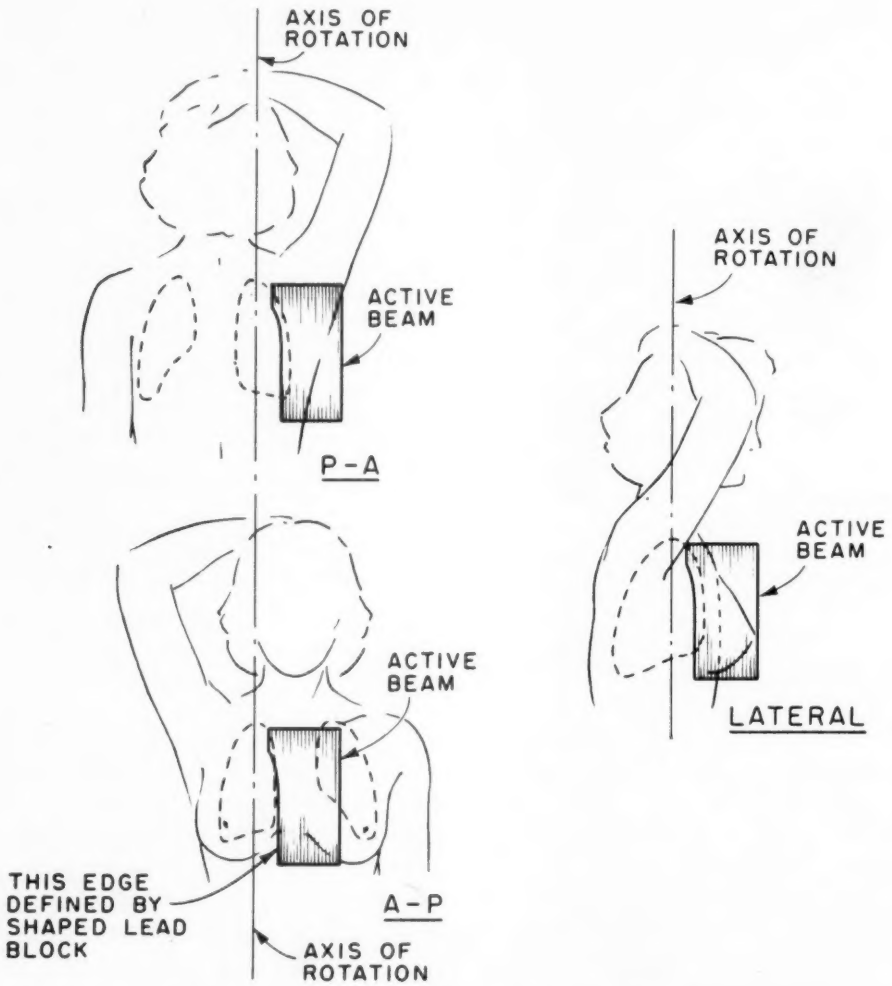

FIG. 8. Location and shape of irradiating beam for Type B rotation.

If one side only is treated, a "cylinder" of radiation is directed into the region, using a field size about 11 by 11 cm. and complete rotation of the patient. With this method a segment of the neck, extending to the midline, and the supraclavicular and infraclavicular regions, from the midline of the body outward to, but not including the humerus, are uniformly treated. The lower margin butts on the breast field. To avoid overlap or undertreatment, the arm position should be the same for both breast and clavicular fields, that is, preferably raised over the head. In order to give a uniform dose both to neck and clavicular regions, a graduated filter is required to reduce the beam intensity at the neck and upper shoulder levels. Dose distributions for this field have been published previously.[11]

If both sides are treated, probably the simplest technique is to use opposing portals, anterior and posterior, with a beam about 23 by 11 cm. and with the middle 3 cm. of it (covering the voice box,

cervical spine, and esophagus) blocked out. With this technique the tangent skin surfaces of the neck and shoulder receive somewhat greater dosage than the thicker tissues, and this may be largely corrected by using a shaped copper filter to reduce the beam intensity over this area, as indicated in Figure 9.

16. VOLUME DOSE WITH SUPERVOLTAGE THERAPY

Both the tumor volume dose and the total body dose in this type of treatment will vary considerably from individual to individual, depending on the degree of obesity of the patient and whether a mastectomy has been performed. An average patient without mastectomy would sustain a tumor volume dose of the order of 14 million gram roentgens for a 6,000 r tumor dose, and a total volume dose of 20 million gram roentgens for the breast field only (Type B), with the axillary supplement. The clavicular field on one side would add a tumor volume dose of 4 million gram r and a total volume dose of 9 million gram r. The total body dose received over an entire treatment in about forty days would, therefore, be about 29 million gram r. For an average patient with a radical mastectomy this would be reduced to 24 million gram r total body dose, and for a small patient after mastectomy perhaps only 18 million gram r would be sustained.

17. ROTATIONAL TREATMENT AT CONVENTIONAL VOLTAGES

This rotational treatment of the breast could be utilized with conventional deep therapy equipment. The main objection to the lower voltage would be the low output of such equipment and the correspondingly long time for each daily treatment. A half-value layer of at least 2 mm. of copper would be desirable with a treatment distance of 70 cm. from target to center of rotation. Treatment would be very similar—"edge of the beam" rotation for 180 degrees with a supplementary axillary portal; aluminum radial and vertical filters. In order to provide sufficient dose to the axilla, the supplement would have to be a direct lateral with this quality of radiation. In contrast to the dose distribution for 2 mev. radiation, given in Figure 6, there will be smaller depth doses received around the lung wall and deep in the breast for a given skin dose. The skin reaction will be much more severe with this quality of radiation. It is doubtful whether more than 4,000 r tumor dose could be delivered in deep tissues in thirty-five days without severe desquamation, *i.e.*, considerably less than a sterilizing dose.

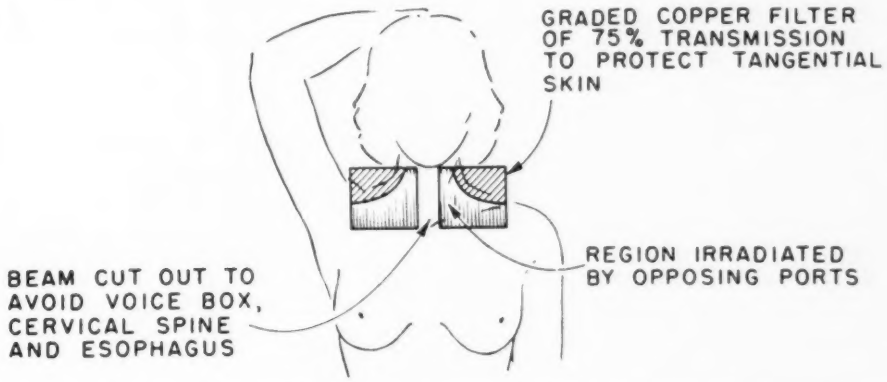

FIG. 9. Arrangement for opposing portal therapy of supraclavicular and neck lymph nodes on both sides.

18. CLINICAL ASPECTS OF RADICAL ROTATION THERAPY

To date, 10 patients have been treated by the methods here described. Six have

received therapy by the Type A rotation and 4 by the Type B. All the cases were Stage III by the Portmann classification; 1 was of the inflammatory type and this patient died of metastases soon after the completion of treatment. All the other patients are alive from five to fifteen months after the completion of treatment, but there is 1 recurrence (in the opposite axilla) to date. Three patients, however, have moderate fibrosis and lymphedema of the arm on the treated side. Tissue reactions have not been untoward following the application of Type B radiation which was developed to decrease the number of "hot spots" produced by Type A.

Immediate skin reactions have not been severe. Every effort is made to avoid "wet" skin reactions.

In several cases the white blood cells and platelets have been temporarily depressed. No lasting damage has been encountered.

Although we believe 6,000 r delivered in forty days to be a sterilizing quantity of radiation, only time can prove or disprove this belief. It is our opinion that tissues receiving such amounts of radiation should not be subjected to surgery, especially if the disease is under clinical control. In 3 of our cases punch biopsies have been reported negative following treatment.

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ROENTGEN THERAPY OF THE ANGINAL SYNDROME

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THE purpose of this study is to attempt to determine the effectiveness of roentgen therapy to the cervicodorsal spine on the anginal syndrome by a "blind" controlled method. Previous reports, all of which are uncontrolled, proclaim roentgen radiation to be of considerable value and suggest its widespread use. We find that roentgen therapy as such has no physiological effect on the anginal syndrome.

HISTORICAL REVIEW

In 1928 the subject of radiotherapy for angina pectoris appeared in the French literature when Barrieu, Lian and Nemours-Auguste[1,4] treated 54 cases by applying several 1 skin unit doses over the cervical and upper dorsal segments. Their results were gratifying in that 31 noted complete relief, and in 8 there was amelioration of pain. Six of their patients died within the period of observation which left 6 with no symptomatic effect. In this country in 1930, Sussman[9] irradiated* 16 cases of "severe angina." Here, again, there were encouraging results, as 6 patients noted almost complete relief and 5 were moderately improved. Four of Sussman's patients did not return for follow-up and 1 died.

Samuel and Bowie[8] in 1931 subjected 19 patients to roentgen therapy† because the usual medical means had failed in preventing further attacks. Of the 19 cases treated, 1 died of an intercurrent disease. The remaining 18, as well as their physicians, felt that the results had been satisfactory and both believed that the roentgen therapy had been the deciding factor in the control of their symptoms. Holmes[3] reported on 17 cases in 1931 at the American Roentgen Ray Society, and he summed up his results by stating that a little over half of the patients showed definite improvement (relief from pain) and a fair percentage of these patients had permanent relief. Wasch and Schenck[10] added their experience in the roentgen treatment of 65 cases of angina pectoris in 1938: of the 65 patients, 10 (15.4 per cent) showed marked improvement; 19 (29.2 per cent) were moderately improved; 15 (23.1 per cent) were only slightly benefited; 21 (32.3 per cent) manifested no appreciable improvement. Thus, 44 (67.7 per cent) of 65 patients received some benefit from treatment. Rinzler[7] published an excellent review of the therapy of cardiac pain in 1948 and listed radiation therapy rather favorably among the miscellaneous agents.

Recently Raab[6] gave a follow-up report on 200 cases of angina pectoris treated by roentgen irradiation to the adrenals. Clinical improvement of all degrees was reported in 152 cases. It is noteworthy that 57 patients, or 28 per cent, of this uncontrolled series of 200 patients received cervical and thoracic roentgen treatments in addition to the adrenal irradiation. Raab gained no clear impression as to the relative merits of this combined treatment as compared to plain adrenal irradiation.

METHOD

Twenty-two consecutive patients, 12 males and 10 females,‡ with a diagnosis of angina pectoris or anginal syndrome, were taken from the Cardiac Outpatient Clinic of the Methodist Hospital. In 3 instances the patients were made available for study

* Sussman's factors were: 200 kv.; 0.5 mm. copper and 4 mm. celluloid filters; 50 cm. target skin distance—effective wavelength 0.166 Å: 4 ma.; field 10×20 cm., arranged so that 20 cm. length extended along the posterior surface of the dorsal vertebrae from the seventh cervical caudally.

† Their technique was: kilovoltage, 140: milliamperage, 5: distance, 20 inches; filtration, 0.25 mm. copper plus 1 mm. aluminum; time, 8–10 min. This gave an average dose of 150 r and was applied every 2 weeks for 4 exposures.

‡ The relatively high proportion of females does not reflect the true sex ratio of the anginal syndrome. The explanation here is the fact that female anginal patients at this institution are more prone to register at the clinic and return for regular follow-up.

as outpatients by their private physicians. The diagnosis was based primarily on a well documented, typical history of precordial pain occurring on effort or concomitant with emotional stress, and relieved within an accepted period of time by rest or nitroglycerin. In all instances these patients were thoroughly investigated by laboratory procedures including chest film, roentgenogram of cervical and lumbar spine, Master's[5] "two-step," esophageal and gastric studies, and Graham test when the diagnosis was in any manner questioned.

One of us (V.L.L.) then explained to all patients that coursing through the left side of the upper spine were nerves which carried the pain they felt with their angina. If these latter nerves were surgically severed, their pain would disappear. Also, if roentgen radiation were properly applied to this area in which the nerves coursed, their pain could be helped. Each patient was then sent to the Roentgen Therapy Department where he signed permission for roentgen treatment. The machine was then set to deliver 400 r, in air, through a 15 by 20 cm. cone over the dorsal spine, extending from the seventh cervical caudally. The factors used were: kilovoltage, 200; milliamperage, 20; focal skin distance, 51 cm.; filtration, 0.5 mm. copper and 1 mm. aluminum. However, in certain cases, at the discretion of the roentgenologist, a lead filter was dropped in place thus preventing any possible exposure to the roentgen ray. Individual records were personally kept by the roentgenologist and not made available until the entire series of follow-up was completed.

Each patient was then followed in the cardiac clinic by one of us (V.L.L.) with particular reference to the interval history and physical examination. Serial electrocardiograms were taken for comparison with those of the pretreatment period but there was no interpretation until the period of observation had ended in the entire series of patients.

The period of follow-up varied from two months to one year with an average of $5\frac{1}{4}$ months. In no instance was any skin reaction to the irradiation evident. Exercise tolerance tests were not employed as a follow-up measure. It is noteworthy that the majority of patients voluntarily kept written records of their course with reference to the frequency of attacks.

CRITERIA FOR IMPROVEMENT

We fully realized the difficulty of determining the value of such radiation therapy in cardiac pain due to the lack of quantitative methods of analysis, and the numerous factors which influence the pain. Gold, Kwit and Otto[2] list eleven circumstances unrelated to therapy that can change the daily course of anginal pain. Pretreatment and posttreatment exercise tolerance tests would probably have been valuable, but such were considered too hazardous for this type of study. Thus, the criteria employed here were: (1) decrease in severity and frequency of attacks, (2) increase in exertional tolerance, and (3) diminished number of nitroglycerin tablets employed. It should be mentioned that we were attempting to relieve pain through interruption of pain pathways and thus not altering the course of the underlying disease. Consequently, even though a patient subsequently died, he was considered improved if, during the period of observation, he had demonstrated improvement by our criteria.

RESULTS

Two patients failed to return for adequate follow-up so this report deals with 20 patients, 10 males and 10 females. The age distribution was between forty-five and seventy-five years, and the average age was fifty-eight. Before the therapeutic records were released, we decided whether or not the patient was improved by our criteria listed above. When we considered the entire group of 20 patients, 11 were improved. However, when they were compared to the treatment record, 11 patients actually received irradiation, and of these, 6 were improved. Nine patients had the

lead filter inserted, but 5 were definitely listed as improved (see Table 1). Four patients died during the follow-up period (cerebrovascular accident, 2; myocardial infarction, 2). Only 1 patient noted complete subsidence of symptoms and he belonged to the treated group.

The electrocardiogram was not employed in the classification of results, as shown in Table 1, and all electrocardiograms were interpreted following the period of observation. Once again, this observer (H.D.F.) was not cognizant of the clinical courses nor of which patients had received irradiation. It is noteworthy that in the group of 9 patients that showed no improvement, this was reflected in the electrocardiograms of 6 patients either by increasing coronary insufficiency, more marked myocardial change, or possible small areas of myocardial infarction. In the improved group of 11 patients, only 1 showed more marked myocardial change. This correlates well with the clinical appraisal of the course of these patients.

TABLE I

ANALYSIS OF RESULTS

	Total	Improved	Not Improved
Treated.....	11	6	5
Not treated.....	9	5	4

In Table 11 an analysis of the electrocardiographic changes is presented. Of the 11 patients showing no significant electrocardiographic change, 7 were treated and 4 were untreated. In those patients showing progression of their electrocardiographic abnormalities, 4 were in the treated group and 3 in the untreated group. Two patients revealed improvement in their tracings and they were in the untreated group. Therefore, we can state that there was no electrocardiographic evidence of benefit from radiation therapy.

One fifty-eight year old male who actually received roentgen treatment demonstrated a bigeminal rhythm (premature auricular contractions) at his first follow-up visit ten days following treatment. This has been a near persistent finding for ten months. This was the only abnormality of rhythm noted following irradiation and we have no basis for assuming that it was definitely related to treatment.

COMMENT

From a controlled "blind" study, it is reasonable to assume that roentgen therapy to the cervicodorsal spine in the treatment of the anginal syndrome has no more than a placebo-like action. When one considers the previous favorable literature on this subject, the study emphasizes the necessity of controlled investigation before a means of therapy can be accurately evaluated. As compared to other authors, we have not elaborated on the action of roentgen irradiation on the sympathetic nervous system because, in the final analysis, its effect is unknown and because in the employment of comparable doses of roentgen rays, we have been unable to demonstrate any therapeutic action.

TABLE II

ANALYSIS OF ELECTROCARDIOGRAPHIC CHANGES

	Patients	Not Changed	Improved	Worse
Treated.....	11	7	0	4
Not treated...	9	4	2	3
Total.....	20	11	2	7

If we are to account for the symptomatic improvement in the untreated as well as the treated group of patients, we must turn to agents other than radiation. These other factors of therapy have been: (1) gaining the confidence of the patient by a physician who was intensely interested in their problem and welfare, (2) offering them a new unheard-of therapeutic measure, and (3) employing a large impressive machine whose theory of action has been somewhat explained to the patient. All these factors would give the patients new hope, confidence, and expectation for real relief of pain. It seems plausible that this

suggestive therapy may have lessened the emotional and stress elements which all clinicians recognize in the etiology of this syndrome.

SUMMARY

1. The literature concerning radiation treatment of the anginal syndrome is reviewed and is impressive.

2. A "blind," controlled investigation of twenty-two consecutive, well documented cases of anginal syndrome is presented.

3. Twenty patients were followed and the results appraised by one observer in a "blind" manner, *i.e.*, the observer had no knowledge as to whether radiation was delivered.

4. Our results show that eleven patients received irradiation and six improved, whereas nine received no irradiation but still five were listed as definitely improved.

5. The serial electrocardiographic study is analyzed and found to correlate well with the clinical appraisal.

6. The conclusions are that cervicodorsal roentgen therapy, as such, has no physiological effect on the anginal syndrome, and therapeutic agents should, by necessity, be evaluated by controlled investigation.

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MULTICENTRIC MAMMARY CANCER DEVELOPING IN PREVIOUSLY IRRADIATED BREAST

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RADIATION-INDUCED tumorigenesis has been a spectacular, tragic and multiform sequel of the action of radiant energy on human tissues, both as a late complication of planned radiation therapy and as an accidental and often occupational by-product. The occurrence of multiple epitheliomas on the hands of pioneer roentgenologists and radium therapists as well as orthopedists who set fractures under roentgenoscopic guidance is the classical and best known example. We are now seeing many women patients who have epitheliomas of the facial skin developing on the basis of roentgen-ray dermatitis caused by the improper use, many years ago, of low voltage roentgen rays (tricho-x-ray) by beauticians for the cure of hirsutism. Osteogenic sarcomas have been reported as occurring in bones subjected to roentgen irradiation for such benign diseases as bone cysts and giant cell tumors or in ribs and mandible injured by roentgen irradiation for cancers of the breast and mouth. Osteogenic sarcomas have also occurred in the bones of workers who accidentally ingested radioactive substances in the luminescent paint for watch dials. Endometrial carcinomas are found with significant incidence in uteri which years before had received intrauterine radium therapy for bleeding of various benign causes. Leukemia has developed in many radiologists, physicists and technicians who have worked with improper protection from roentgen rays and radium. The later survivors of the Hiroshima atomic blast are now acquiring leukemia and other radiation-induced neoplasias.

The normal mammary gland is not commonly bombarded with large doses of irradiation and if it does fall in the therapeutic beam of roentgen radiation for intrathoracic tumors, the patient seldom lives for a number of postirradiation years during which changes might occur in the breast tissue. The immediate changes occurring in normal breast tissue have been known for twenty years: Lee, Pack, Quimby and Stewart studied 120 patients with mammary cancer who received measured tissue doses of roentgen rays and radium therapy and then had mastectomies four to twelve weeks later. The microscopic alterations in the apparently normal portions of these breasts were interesting atrophic and metaplastic changes which at that time led to speculation concerning possible future developments were the breasts normal and had been left intact.

A patient with Hodgkin's disease protruding through the right anterior chest wall and elevating the right breast received roentgen therapy intermittently over a period of three years with perfect clinical regression but with marked telangiectasia of mammary skin and diffuse firm fibrosis of the right breast. Ten years later a cancer developed in this breast requiring radical mastectomy. Two grossly discernible cancers were found and innumerable small carcinomas in situ with hyperplasias and precancerous changes present everywhere within the ductal tree.

The radiation damage long existent in the breast and the later occurrence of multicentric mammary cancers in the same organ my be coincidental, but we have never examined a breast with such extravagant neoplastic changes. This case report, therefore, is presented to illustrate another instance of possible radiation-induced neoplasia.

REPORT OF CASE

In 1941, S. G., a woman, aged twenty-nine, during the last trimester of her first and only

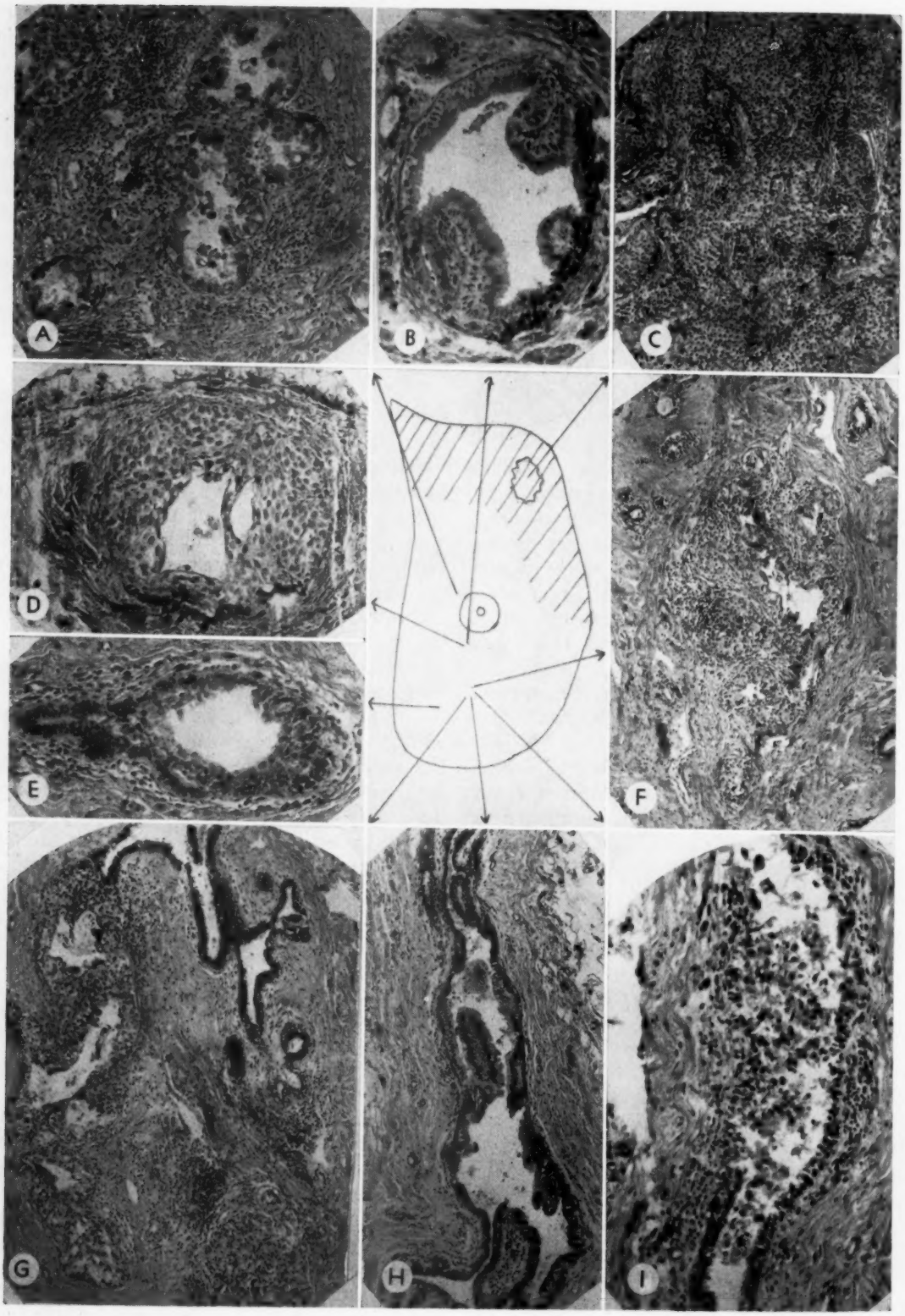
pregnancy, noticed an enlarged lymph node in the right supraclavicular region, associated with generalized pruritus. In August, 1941, after the birth of the child, a cervical node was surgically excised; the microscopic diagnosis was Hodgkin's disease. At this time, pathologically enlarged lymph nodes were present in the right lower neck, the right axilla, and particularly in the right chest, where there was a marked prominence to the right side of the mediastinum protruding between the ribs and beneath the medial two-thirds of the right breast. During the course of the succeeding three years high voltage roentgen therapy was given twice weekly and sometimes at more frequent intervals with repetition of dosage and protraction of the irradiation in such a fashion it would be impossible to estimate the dose received. Three years later (April, 1944), when she was first seen by us, the skin of the right anterior chest wall and lower neck were markedly telangectatic with subdermal fibrosis and loss of the elasticity of the tissues, including the major portion of the right breast. One lymph node excised from the right axilla at this later date was positive for Hodgkin's disease. There was a tremendous protrusion of the tissues in the right anterior chest wall beneath the breast. This swelling corresponded with the widening of the mediastinum and the changes in the right hilar lymph nodes in keeping with the nature of this disease. The patient had a fever of 101 to 102° F. maximal. There was no clinical or roentgenographic evidence of skeletal involvement except a defect in one of the right anterior ribs. We were unable to secure the exact treat ment factors prior to our original examination in April, 1944, but the radiation damage had been considerable as was clinically evident in the nature of the skin and the associated fibrosis of the breast.

The treatment given in 1944 was to three fields—the right chest anteriorly, the right chest posteriorly and the right axilla, employing 250,000 volts, 1.5 mm. of copper filter, 70 cm. target skin distance for the chest field and 50 cm. target skin distance for the right axilla, 30 ma. of current, fields measuring 22 by 17 cm. for the chest and 8 by 16 cm. for the axilla giving 300 roentgens daily until a total dose of 1,200 r×3 was administered. The dosage given was considered to be palliative, although the total low dose was intentional for fear of causing ulceration in the heavily damaged skin. Regression occurred promptly at the sites of the mass protruding from the chest wall and in the axillary and supraclavicular nodes as well, the latter group of which were in the single field employed to irradiate the axilla. In the course of the succeeding seven years, no further roentgen treatments were given, and the patient gradually improved in health. Blood transfusions were given at less frequent intervals and the chronic dermatitis and pruritus also subsided. At no time during the succeeding four years has there been any evidence of recurrence of Hodgkin's disease, which has apparently been controlled without additional therapy.

Early in 1951 a small nodule 3 cm. in diamter was found in the upper inner quadrant of the right breast. An aspiration biopsy was done which was reported as mammary cancer. A right radical mastectomy was performed with considerable difficulty due to the fibrosis and scarring of the breast and axilla. The wound healing was impaired due to the radiation damage. Subsequent pathological studies proved the presence of multiple carcinomas of the right breast, metastatic to numerous lymph nodes in the axilla. There was no evidence of distant dissemination of the breast cancer.

Gross Pathological Anatomy of Right Breast and Axilla. The specimen included the right breast, overlying skin, pectoral muscles, axillary lymph nodes, and adipose tissue. The mammary skin is firm and is telangiectatic. In the upper inner quadrant 5 cm. to the left and 5.5 cm. above the mulberry-shaped nipple, there was a roughly round, hard, fixed, gray-white mass. The remainder of the breast was resilient and silvery white. There were nine enlarged, hard, axillary lymph nodes.

Microscopical Study. The tumor of the upper inner quadrant consisted of ducts filled with large fairly homogeneous cells (Fig. 1*C*). The majority of the nuclei were vesicular, moderately pale staining and had prominent but not large nucleoli. The cytoplasm was finely granular and amphoteric. Interspersed were several hyperchromatic macronucleoli. Mitoses were abundant, usually normal in type, occasionally very bizarre. Pagetoid cells were present in very scanty numbers. A rare small lumen was discernible and minute necrotic foci were scattered here and there. There was a severe desmoplastic reaction. The skin had a thin epithelium, a relatively thick stratum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corneum, increased pigmentation, hyaline degeneration of the corium, and telangiectasia at the papillary tips.

The lower outer quadrant had profound changes. The nipple appeared normal. Just distally, there was an irregularly distributed mild myo-epithelial hyperplasia. In a few ducts, the inner layer showed papillation (Fig. 1*B*) or almost filled the lumen (Fig. 1*D*), and had a much larger cell with a faintly eosinophilic cytoplasm and a large vesicular nucleus. It contrasted sharply with the smaller more deeply stained basal layer. These changes extended into the more peripheral parts of the quadrant (Fig. 1*E*). The larger cell becomes more numerous, anisocytosis becomes more prominent and in one focus (Fig. 1*F*), there was marked nuclear and nucleolar macrocytosis, hyperchromatism, several bizarre mitoses and a dense inflammatory reaction. Other ducts showed marked papillation and myo-epithelial hyperplasia in which both cell layers remain opaque. In these ducts (Fig. 1*H*), there were small, sharply demarcated nests of tall cylindrical cells with eosinophilic cytoplasm and plump long nuclei, either covering the papillary projections or lining the wall. Some of these ducts (Fig. 1*G*, *I*) had sharp transitions to frankly neoplastic cells. Throughout the quadrant, there were groups of normal ductules, ducts with mild hyperplasia and dilated ducts surrounded by an inflammatory collar. The connective tissue varied from normal to hyaline in character.

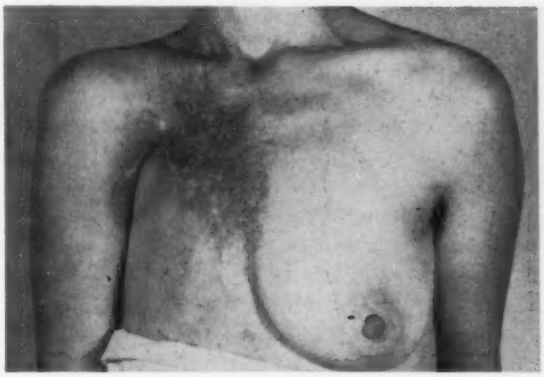

FIG. 2. Postoperative wound. To illustrate the telangiectasia and other changes in the irradiated skin of the breast.

FIG. 1.

(*A*) Primary carcinoma of upper outer quadrant. The epithelial cells filling the ducts show great anisocytosis, some giant forms, marked hyperchromatism, many macronucleoli and some bizarre mitoses. The tumor is much more anaplastic than the one in the upper inner quadrant, which was clinically evident. ×135

(*B*) Duct in lower outer quadrant showing a nonmalignant hyperplasia of the epithelium. In addition to the myo-epithelial hyperplasia, the inner layer has papillation and tall cylindrical cells with eosinophilic cytoplasm and large vesicular nuclei. ×160

(*C*) Primary carcinoma of upper inner quadrant, the clinically evident tumor. The tumor cells are fairly homogeneous in appearance. Scattered among them are cells showing hyperchromatic macronuclei and anisocytosis. The metastatic axillary cancer was of similar nature. ×90

(*D*) Duct in lower outer quadrant showing nonmalignant hyperplasia. The lumen is almost filled with large eosinophilic cells similar in character to those illustrated in (*B*). It appears to be a slightly more advanced stage of the same condition. ×160

(*E*) Lesion in lower outer quadrant with hyperplasia similar to that illustrated in (*B*) and (*D*), but with some scattered carcinoma cells, showing more irregularity in cell size and hyperchromatism of nuclei. ×160

(*F*) Lesion in lower outer quadrant showing transition of the eosinophilic hyperplastic epithelial cell illustrated in (*E*), to nests of carcinoma cells lining ducts having hyperchromatic macronuclei. The carcinoma nests are similar to those in (*A*) but are less anaplastic and lack the giant size. ×63

(*G*) Lesion in lower outer quadrant showing ducts with marked myo-epithelial hyperplasia and sharp transition to frank carcinoma. ×90

(*H*) A nonmalignant papillomatous lesion of the lower outer quadrant. There is both a marked myo-epithelial hyperplasia and nests of tall eosinophilic epithelial cells lying along the wall and covering some papillary projections. Similar foci were present in the upper outer quadrant. ×63

(*I*) Marked myo-epithelial hyperplasia in lower outer quadrant showing sharp transition to carcinoma. The carcinomatous cells display anisocytosis, hyperchromatism and macronucleation. They have desquamated into the lumen. The underlying basement membrane is destroyed. The carcinomatous lesions of the lower outer quadrant (*E*, *F*, *G*, *I*) originate at separate foci in the ducts of this quadrant. ×135

The upper outer quadrant, near the nipple, has a nest of ducts (Fig. 1*A*) filled with large opaque cells whose nuclei are frequently multiple, show great anisocytosis, some giant forms, marked hyperchromatism, many macronucleoli and some bizarre mitoses. There is a dense lymphoid and plasmacytic inflammatory reaction. A few nests nearby have intense myoepithelial hyperplasia with nests of tall cylindrical cells, similar to those found in the lower outer quadrant. More peripherally, the quadrant has minor changes. A few ducts are dilated with amorphous material and fat-containing cells or have some hyperplasia. The greater portion of the breast tissue appears normal.

Almost all of the axillary lymph nodes were totally replaced by tumor similar to that found in the inner upper quadrant.

Diagnosis. Primary multicentric carcinomas of the right breast with axillary lymphatic metastases.

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A METHOD OF RAPID CHEST PHOTOFLUOROGRAPHY*

By H. STEPHEN WEENS, M.D., *and* ALBERT A. RAYLE, JR., M.D.

ATLANTA, GEORGIA

THE value of routine photofluorographic chest examination for all patients admitted to a hospital is generally acknowledged. The presence of the hospital professional staff, technical personnel and facilities would appear favorable for the conduction of such a program. In actual practice, however, difficulties arise which may seriously interfere with its efficiency.[1]

Many of the difficulties may be attributed to the fact that considerable time may elapse between exposure of a photofluorogram and its interpretation. This makes it impossible, for example, to prevent admission of a patient with infectious tuberculosis to a general ward. Also, certain administrative problems as well as early dismissal of patients from hospitals and clinics makes roentgenologic re-examination of every case with suspicious survey findings difficult to achieve.

It would therefore appear desirable in hospital survey work to use a method which would permit immediate processing and interpretation of photofluorograms.

For these reasons we have adapted the system of the Land Polaroid camera to photography of the fluoroscopic screen. With this process it is possible to obtain a finished photofluorogram of the chest, ready for interpretation, within one minute.

DESCRIPTION OF APPARATUS

The camera assembly employed for this purpose is outlined in Figure 1. A light-tight hood contains at one end a Patterson B-2 fluoroscopic screen with grid, and at the other end a Kodak Ektar f:1.5 lens as used in conventional photofluorographic cameras. The image is recorded by the back assembly of a commercially available Polaroid camera which has been firmly mounted so that the plane of the film is approximately 7.6 cm. from the back element of the optical system. By incorporating special shutters it is possible to focus the lens without difficulty and to prevent unnecessary light exposure of the Polaroid film. With this arrangement and the dimensions given in Figure 1, a picture size of 70 by 90 mm. is obtained. This is opposed to the 60 by 70 mm. image recorded by a conventional 70 mm. camera.

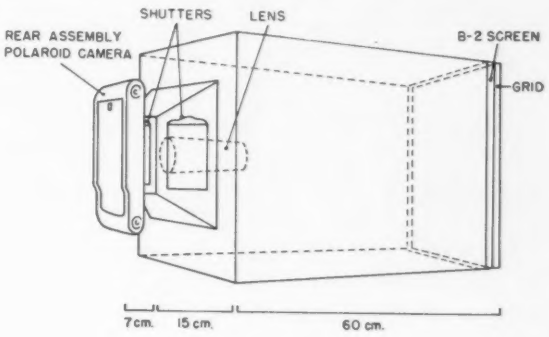

FIG. 1

The Land Polaroid camera employs two rolls of paper film, one light sensitive and the other chemically sensitive. Attached to the chemically sensitive roll at proper intervals are paper pods, each of which contains in a gel agent enough standard chemicals to develop and fix one print. After the light sensitive paper is exposed, it and an equal length of the chemically sensitive material are drawn between two rollers. The pressure of the rollers bursts the paper pod of chemicals at the leading edge of the print to be processed. This spreads the developer-fixer reagent evenly between the negative and the future print. As the exposed silver grains are developed, the fixer dissolves the unexposed silver salts and carries them through the matrix to the paper. Here they are deposited in the metallic state to form the positive image. This entire process is completed in one minute.

The roentgen exposures necessary with this method are estimated to be two to three times those used in conventional photofluorography. In an average patient with an anteroposterior chest diameter of 20 cm., measured at the level of the manubriosternal junction, exposure fac-

* From the Departments of Radiology, Emory University School of Medicine and Grady Memorial Hospital, Atlanta, Georgia.

tors are 200 ma., 95 kv., 0.5 second with a target screen distance of 36 inches. So far, we have not incorporated a Morgan-Hodges phototimer[2] into the unit, though this would be possible.

The present process furnishes a positive image of the fluoroscopic screen as opposed to the negative image obtained in conventional photofluorography and roentgenography. Objection to this is overcome as the observer gains experience with this method.

COMMENT

It is interesting that Land, the inventor of the Polaroid photography process, envisioned its application to roentgenography several years ago. Recently the practical use of this process in direct roentgenography has been demonstrated and a special cassette for the Polaroid system has been constructed.[3,4] Reports of this development have stimulated us to apply this principle to photofluorography. Our results indicate that with this method, using small objects of high density such as a wire mesh, the detail in photofluorograms approaches that obtained with conventional 70 mm. film. However, the short latitude of the Polaroid photographic material in the dark gray and black shades makes more difficult the recording of small, faint shadows as in minimal tuberculosis. Nevertheless, infectious tuberculosis, various types of cardiac and aortic disease and diaphragmatic abnormalities, as well as mediastinal tumors, may be clearly depicted with this method. Figures 2, 3, 4 and 5 are rapid photofluorograms of various pathologic conditions. Conceivably, this process may be improved by changes in the contrast and speed of the photographic materials as well as by introduction of a transparent base instead of paper.

Rapid photofluorography for the screening of hospital patients has many advantages which become evident on consideration of the difficulties encountered with present methods. Recently Boucot and her associates[1] investigated the effectiveness of hospital chest surveys by analysis of such programs in four teaching institutions. In most of these programs the authors discovered several shortcomings which could be attributed to lack of personnel, insufficient record keeping and, particularly, to difficulties in obtaining proper roentgenological and clinical re-examination of patients with suspicious pulmonary lesions. In this connection, it should be emphasized that one of the principal purposes of chest survey examination of all hospital admissions is the detection of infectious tuberculosis in order to protect hospital personnel and other patients.[1] With rapid development of all photofluorograms, immediate interpretation of these films becomes feasible. By locating a photofluorographic unit of this type close to the main roentgen department, photofluorograms may be currently interpreted. In those patients in whom suspicious lesions are detected, conventional roentgenographic procedures may be performed in direct sequence to the survey film and before admission of the patient to the ward. Return visits of the patient to the roentgen department and all clerical procedures necessary for re-examination are in this manner largely eliminated.

In addition, this method can reveal valuable information in those patients who are admitted for operative procedures. Photofluorographic findings in these patients now are frequently not appreciated since the results are not available until after operation. With rapid photofluorography it should be possible in these patients to detect, prior to anesthesia and operation, unsuspected pulmonary and cardiac changes as well as mediastinal or diaphragmatic abnormalities.

With improvements in the optical system and recording media this process may well be adapted to other procedures which are now in the realm of direct roentgenography.

SUMMARY

A method of rapid chest photofluorography is presented. This process employs the Land Polaroid photography principle

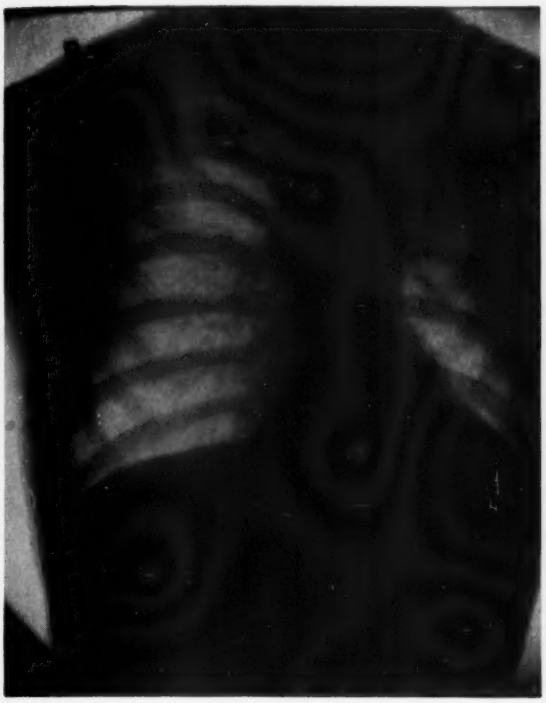

Fig. 2. Pulmonary tuberculosis.

Fig. 3. Pulmonary abscess.

Fig. 4. Pneumonia.

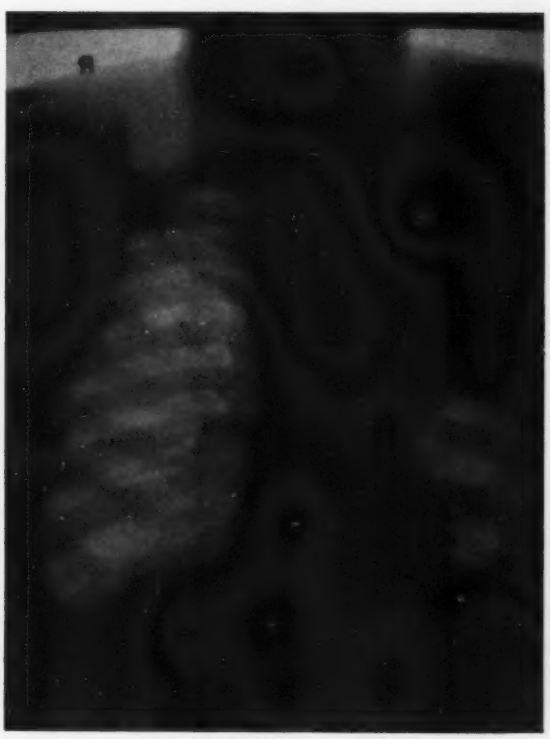

Fig. 5. Bronchogenic neoplasm.

and furnishes a finished photofluorogram in one minute. The advantages and limitations of this process are briefly discussed.

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Thirty-fifth Annual Meeting: Plaza Hotel, St. Louis, Mo., April 19, 20, 21 and 22, 1953.

EDITORIALS

UNTOWARD EFFECTS OF CEREBRAL ANGIOGRAPHY

SINCE the introduction of pneumoencephalography and ventriculography by Dandy, no other roentgenological procedure has contributed as much toward the advancement and refinement of diagnosis in intracranial lesions as cerebral angiography. The initial attempts, which followed Egas Moniz's first injection of the carotid artery with a contrast substance in 1927, were followed by many difficulties as was to be expected considering the very exacting nature of the procedure, and for a time it appeared as though the method might not find useful practical applicability. During the last decade, however, excellent contributions made by an impressive array of outstanding clinical investigators have helped to overcome all these difficulties and to establish cerebral angiography as a method of examination of considerable diagnostic value.

It is now fairly well agreed that injection of the opaque substance into the carotid artery brings about an opacification of the blood vessels supplying about two-thirds of the intracranial contents. The vascular system of the remaining one-third can best be demonstrated by injection of the opaque medium into the vertebral artery and recently several authors have published important data on the usefulness of this technique. Of course, other routes of injection may also be employed as, for example, the retrograde filling of the vertebral artery via injection of the subclavian artery or the right common carotid artery, or through catheterization of the vertebral artery from the radial artery, and so forth. Three factors are chiefly responsible for the great simplification of cerebral angiography using any of the aforementioned approaches: the percutaneous method of injection of the blood vessels, the replacement of general with local anesthesia and the availability of rapid cassette changers, reducing the need for large amounts of the opaque substance. These factors have brought cerebral angiography within the sphere of daily activity of the radiologist, and the scope of the method is being continuously enlarged in an attempt to delineate more accurately structural changes usually associated with various types of intracranial lesions.

Although the untoward effects which follow cerebral angiography have been amply discussed in the literature, it may appear advisable to re-emphasize here the fact that the method, even with the best executed techniques, is not altogether harmless. Very recently, Abbott, Gay and Goodall[1] gave an excellent appraisal of the coincidental reactions and complications of cerebral angiography. Their study was based on personal experience with 174 examinations in 150 cases and a thorough review of the literature. In their personal group, serious untoward complications were noted in 17 cases with five fatalities and in 2 cases less serious though alarming signs were observed. These figures are somewhat higher than those given by other investigators but the authors state that their purpose in publishing them was to call attention to the fact that "cerebral angiography may not be as innocuous a procedure as some have indicated." They believe that some of these complications may result from ill-advised and poorly applied techniques or from unsuitable and too concentrated contrast solutions, but others must be assigned to the inherent danger of the procedure itself.

Abbott, Gay and Goodall[1] divide the clinical complications from untoward effects of cerebral angiography observed in their material into intracranial and extracranial. The intracranial complications are subdivided into the following groups: I. *Fatal complications:* (A) Sudden onset of unconsciousness, respiratory failure and subsequent death occurring with (1) a normal cerebrovascular system and (2) in atherosclerosis and thrombosis of the internal carotid and cerebral infarction. (B) Immediate convulsions, subarachnoid hemorrhage (from ruptured aneurysm) during diodrast angiography and subsequent death. (C) After a subarachnoid hemorrhage, angiography producing transitory hemiplegia, followed by recurrent subarachnoid hemorrhage and death. II. *Non-fatal complications* (*permanent*): (A) Hemiplegia. (B) Accentuation of preexisting hemiplegia with associated cerebral symptoms. III. *Non-fatal complications* (*transitory*): (A) Hemiplegia (motor, sensory or both). (B) Hemiparesis (motor, sensory or both), and associated with these have been total aphasia, motor aphasia (various types), sensory aphasia, homonymous hemianopsia and mental confusion. (C) Cerebellar fits (transitory decerebrate state) with immediate recovery (in 2 patients with vertebral angiography using diodrast). (D) Minor fever (up to 102.6° F.) with or without transitory mental confusion.

The extracranial complications are summarized as follows: (1) Cervical hematoma necessitating tracheotomy (pericarotid and peritracheal hemorrhage). (2) Severe irritation of cervical soft tissues, with fever and pain. (3) Temporary vagus or laryngeal nerve paralysis. (4) Transitory punctate cutaneous hemorrhages over ipsilateral face, neck, conjunctivae and retina. (5) Transitory radiculitis (in vertebral angiography). (6) Prolonged irritation and paralysis of the cervical sympathetics from extracarotid extravasations of diodrast. To these may be added some other complications collected from the literature, including thrombosis of the longitudinal sinus and connecting veins; thrombosis of the common and/or internal carotid artery; transitory Brown-Séquard syndrome; urticaria; aspiration pneumonia, and so forth.

Abbott, Gay and Goodall also discuss in extenso the various etiologic factors which may enter into operation in causing the above enumerated untoward effects. Among these, due consideration is given to the mechanical and hydrodynamic factors, the reflex and direct chemical vasospasms, the disturbance of the blood-brain barrier, air and clot embolisms, sensitivity to the contrast substance and the severe dilution of the cerebral blood with saline. Obviously, however, further extensive investigations are required before all the problems involved can be satisfactorily evaluated.

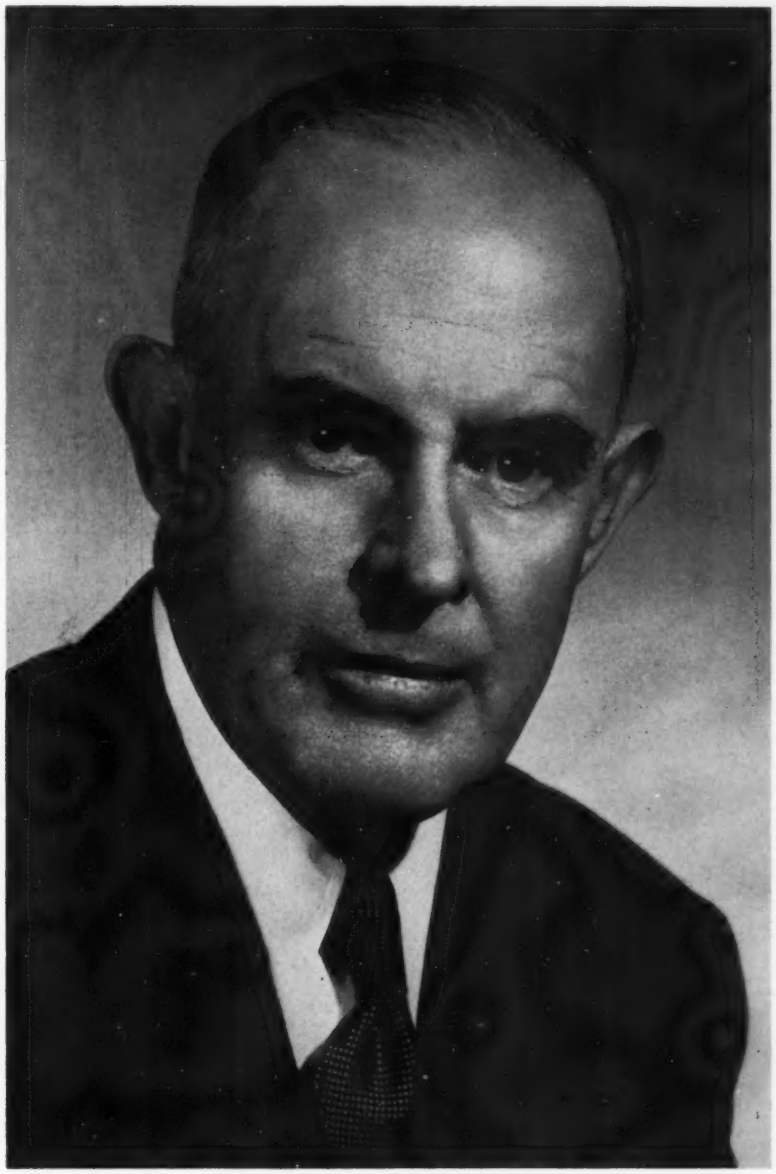
To the radiologist a knowledge of the clinical manifestations of the possible untoward effects observed in cerebral angiography is of the utmost importance. The method is of great diagnostic value in a variety of intracranial lesions and will no doubt be used routinely in well selected cases. An increasingly high proportion of successful examinations will be obtained as experience increases and technical development advances. Yet it is probable that some of the accidents will not be eliminated for a considerable period of time, if at all. The indications for the proper approach, therefore, should be considered with great care before the examination is undertaken and if other methods, as, for example, peumoencephalography or ventriculography, give sufficient information, cerebral angiography should perhaps not be performed. There is a unanimity of opinion in the literature that large quantities of any of the opaque substances used are contraindicated and that the weaker solutions are to be preferred to the stronger solutions. Abbott, Gay and Goodall attribute

[1] Abbott, Kenneth H., Gay, James R., and Goodall, Robert J. Clinical complications of cerebral angiography. *J. Neurosurg.*, May, 1952, *9*, 258–274.

a significant number of the accidents encountered in their series to the use of diodrast, which is an acutely irritating substance. They strongly recommend that when this drug, or for that matter any other iodopyracet, is injected, only the 35 per cent solution should be used in quantities not exceeding 40 cc. In patients with suspected degenerative or inflammatory cardiovascular disease, they prefer thorotrast, notwithstanding the objections of many other investigators, until a more suitable drug is found.

The institution of proper therapeutic measures to combat the untoward effects of cerebral angiography is of equal importance. Abbott, Gay and Goodall use blocks with 1 per cent procaine of the stellate and superior cervical sympathetic ganglions and more recently of the cervical sympathetics before doing angiography. Continuous intravenous histamine therapy with repeated lumbar puncture is of value in some cases. Osmotic agents used as transfusions of serum albumin, concentrated plasma and whole blood aid in reducing cerebral edema by removal of intercellular fluid. The administration of oxygen by nasal catheter and finally tracheotomy are undertaken in all unconscious patients when mucous secretions appear to be blocking the tracheobronchial tree. Abbott, Gay and Goodall state that by observing these precautions they were able to reduce markedly the incidence of complications in a subsequent series of over one hundred percutaneous cerebral angiographies.

It is evident from the foregoing that cerebral angiography must still be considered a serious intervention, despite the great simplification of the injection and the many technical improvements achieved lately. A close cooperation between the neurosurgeon and the radiologist is essential in conducting the examination. Such teamwork is also of distinct advantage in instituting prompt counter measures as soon as signs of an untoward effect become clinically manifest.



DAVIS SPANGLER
1892-1952

DR. DAVIS SPANGLER, well known Texas radiologist, died April 13, 1952, of a heart ailment which recurred after a previous attack in the summer of 1951.

A native of Washington, D.C., Dr. Spangler was born September 30, 1892, a son of Wm. A. and Mary (Davis) Spangler. He attended high school in Bonham, Texas, and was graduated in medicine from the University of Texas Medical Branch in Galveston in 1913. After serving two internships, one at John Sealy Hospital in Galveston and the other at St. Vincent's Sanitarium in Sherman, Texas, he began practice at Sherman, remaining there until 1921 except for two years in military service. He enlisted in the Army in 1917 and, following training in military

roentgenology in Kansas City, Missouri, was sent to France. He was assigned to Base Hospitals No. 31 and No. 36 as radiologist. He was discharged in 1919 with the rank of captain.

In 1921, he joined the newly organized Dallas Medical and Surgical Clinic. In 1938 he resigned from this group and began practice in the Medical Arts Building where he continued his specialty until his final illness. During recent years he was associated with Dr. Glenn D. Carlson, Dr. Wm. G. McPheron and Dr. W. H. Barekman.

Upon graduating from medical school, Dr. Spangler joined the Texas Medical Association through the Grayson County Medical Society. He maintained his membership in the state organization and in the American Medical Association, more recently through the Dallas County Medical Society which he served as president in 1943. He was secretary of the section on Radiology and Physiotherapy of the state group in 1937 and again in 1950. During World War II, he was county chairman of procurement and assignment of physicians. Dr. Spangler's memberships included the Fort Worth-Dallas Intercity Radiological Club, Texas Radiological Society, American Roentgen Ray Society, and Radiological Society of North America of which he was a former vice-president. He was a fellow of the American College of Radiology and a councilor for Texas for this organization in recent years. He was a diplomate of the American Board of Radiology. He was a member of the Dallas Southern Clinical Society, Clinical Assistant Professor of Radiology at Southwestern Medical School of the University of Texas, and a member of the medical staffs of Scottish Rite Hospital for Crippled Children, Children's Medical Center and Medical Arts Hospital.

Dr. Spangler was a member of the Methodist Church, Kiwanis Club, Dallas Country Club, High Noon Club, Knife and Fork Club and Koon Kreek Klub of Athens, Texas. He was a sports fan, especially enjoying hunting and fishing.

Dr. Spangler held the highest honor in Scottish Rite Masonry, the 33rd degree. He also held the highest office, Potentate, in Hella Temple Shrine. Most active in Scottish Rite work, he was a member of other masonic orders. He was junior general elect in St. Mark's Conclave; an honorary member of the Royal Order of the Ducks; and the Royal Order of the Jesters.

Those of us closely associated with him in radiological practice will long remember his zeal in attacking the task at hand. Even during his final illness he gave unsparingly of his energy to a current economic problem in radiology, even at the risk of personal physical disability.

Dave Spangler leaves behind him a host of friends in and out of radiology. He will be deeply mourned and greatly missed by them.

Surviving Dr. Spangler is his wife, the former Mrs. Aurelia Cockrell Kurth, whom he married in 1942.

GLENN D. CARLSON, M.D.

JULIUS B. WANTZ
1874-1952

THE business life of Julius B. Wantz covered the entire period of Radiology from the discovery of the X-ray in 1895 to the time of his death on April 6, 1952. At the time of Röntgen's discovery Julius Wantz, then only twenty-one years old, was conducting a small business in the basement of his home in Chicago where he manufactured a variety of electrical appliances, including small motors. About that time, with C. F. Samms, he formed the Victor Electric Company and began the manufacture of electric motors to operate static machines used for production of roentgen rays. From then on his life and work were identified with the invention and construction of apparatus for medical radiology. His small company expanded in

1916 to become the Victor Electric Corporation, later the Victor X-ray Corporation, still later the General Electric X-ray Corporation, and now the X-ray Department of the General Electric Company.

Julius Wantz was both an inventor and designer of roentgen apparatus and numerous honors were conferred upon him for his original contributions in this field. In 1940 he was honored as one of fifty-nine "modern pioneers" at a dinner celebrating the 150th anniversary of the United States Patent System. The following tribute was paid to him at that time: "Julius Wantz, inspired by Professor William Konrad Roentgen, first experimented with X-rays in 1895 and envisioned great possibilities for this industry which he helped establish. Possessed of a brilliant, far-seeing mind and with an unusual flair for shaping raw materials into useful machines, he designed, constructed, and manufactured X-ray producing equipment the equal of which had never been conceived.

"His breadth of knowledge, together with his originality and mental alertness, created a new industry, dedicated to the manufacture and sale of X-ray and electromedical equipment which alleviated pain and removed ailments otherwise impossible."

The pioneer spirit of Julius Wantz was equaled only by those other pioneers in medical radiology who had the vision to see far-reaching possibilities in the application of the roentgen ray to the diagnosis and treatment of disease. Progress in radiology would have been frustrated or long delayed had it not been for the contributions of the inventors and designers of apparatus for production and application of roentgen rays in many fields of medicine. Among these men Julius Wantz was in the front ranks during his entire career of more than fifty years.

With all of his genius "J.B.," as many of us knew him, was a man of fine ideals. He conducted his life on a high plane of honor and integrity, and in every contact was always a kindly gentleman. The early advertisements of apparatus designed by him often contained the slogan, "Built by a man who finishes the job." No better epitaph could be proposed for him for he was a man who always "finished his job."

A. C. CHRISTIE, M.D.

B. SWAYNE PUTTS
1882-1952

DR. B. SWAYNE PUTTS of Erie, Pennsylvania, died in Fort Lauderdale, Florida, of arteriosclerotic cardiovascular disease on January 31, 1952. He had been an invalid nearly continuously since May, 1947.

Dr. Putts was born in Baltimore, Maryland, and received his A.B. in 1902 and his M.D. in 1906 from Johns Hopkins University. After an internship at Allegheny General Hospital, Pittsburgh, and several years' training in internal medicine and tuberculosis, he located in Erie in 1911. Following five years of general practice, he returned to Johns Hopkins Hospital and Dr. Baetjer for graduate training in roentgenology. He soon became the leader in this field in the Erie area and developed his specialty in the two general hospitals of Erie: Hamot and St. Vincent's. He also maintained an office in downtown Erie for the practice of roentgenology. Dr. Putts was a diplomate in roentgenology and was a fellow of the American College of Radiology. Active membership was held in the Radiological Society of North America and the American Roentgen Ray Society. He had been a president of the Pennsylvania Radiological Society and of the Erie County Medical Society. In his earlier years a winner at lacrosse and tennis and later on in golf, he was also an expert at bridge, which was his hobby of later years.

Married to Ednah Buhl in 1910, he was the father of one daughter, Christine (Mrs. Henry W. Buhl). Dr. Putts will be remembered in the Erie area for his long and important service as a consultant in the quarter century between World Wars I and II. He firmly established roentgenology in the area in the basic framework of medical practice. Always a critical observer, his value as a consultant was accepted in all the related branches of clinical medicine.

RALPH D. BACON, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

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Secretary, Dr. J. E. Wirth, 635 Herkimer St., Pasadena 1, Calif. Annual meeting: Plaza Hotel, St. Louis, Mo., April 19–22, 1953.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y. Annual meeting: Netherland-Plaza Hotel, Cincinnati, Ohio, December 7 to 12, 1952.

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ARIZONA RADIOLOGICAL SOCIETY
Secretary, Dr. R. Lee Foster, 15 E. Monroe, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

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ATLANTA RADIOLOGICAL SOCIETY
Secretary, Dr. Albert A. Rayle, Jr., 478 Peachtree St., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, October through April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

CENTRAL OHIO RADIOLOGICAL SOCIETY
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Elbert K. Lewis, 6337 S. Harvard Ave., Chicago, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Mortimer Lubert, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

COLORADO RADIOLOGICAL SOCIETY
Secretary, Dr. W. P. Stampfli, 1933 Pearl St., Denver, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

CONNECTICUT VALLEY RADIOLOGIC SOCIETY
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday October and April.

DALLAS-FORT WORTH ROENTGEN STUDY CLUB
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. J. C. Cook, Harper Hospital, Detroit, Mich. Meets monthly first Thursday, October to May, at Wayne County Medical Society Building.

EAST BAY ROENTGEN SOCIETY
Secretary, Dr. Dan Tucker, 434 30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

FLORIDA RADIOLOGICAL SOCIETY
Secretary, Dr. A. Judson Graves, 2002 Park St., Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

GEORGIA RADIOLOGICAL SOCIETY
Secretary, Dr. Robert M. Tankesley, 218 Doctors Bldg., Atlanta, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

GREATER MIAMI RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice Greenfield, Ingraham Bldg., Miami, Fla. Meets third Wednesday of each month at Veterans Administration Building.

HOUSTON RADIOLOGICAL SOCIETY
Secretary, Dr. F. M. Windrow, 1205 Hermann Professional Bldg., Houston, Texas. Meets fourth Monday each month.

IDAHO STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Alfred M. Stone, St. Lukes Hospital, Boise, Idaho. Meets annually at same time as Idaho State Medical Association.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. Stephen L. Casper, 1101 Maine St., Quincy, Ill. Meets three times a year.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

IOWA X-RAY CLUB
Secretary, Dr. James McMillan, 1104 Bankers Trust Bldg., Des Moines, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. The scientific section is held in the autumn.

KANSAS RADIOLOGICAL SOCIETY
Secretary, Dr. Charles M. White, 3244 E. Douglas, Wichita 8, Kan. Meets annually with State Medical Society.

KENTUCKY RADIOLOGICAL SOCIETY
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

KINGS COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. Marcus Wiener, 1430 48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

LOS ANGELES RADIOLOGICAL SOCIETY
Secretary, Dr. John B. Hamilton, 210 N. Central Ave., Glendale 3, Calif. Meets second Wednesday each month at Los Angeles County Medical Association Building.

LOUISIANA RADIOLOGICAL SOCIETY
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

MAINE RADIOLOGICAL SOCIETY
Secretary, Dr. C. F. Miller, Central Maine General Hospital, Lewiston, Maine.

* Secretaries of societies are requested to send timely information promptly to the Editor.

Miami Valley Radiological Society
Secretary, Dr. G. A. Nicoll, 134 Apple St., Dayton, Ohio. Meets second Friday of fall and winter months.

Mid-Hudson Radiological Society
Secretary, Dr. J. W. Walton, Horton Memorial Hospital, Middletown, N. Y. Meets 8:30 P.M., fourth Tuesday each month, September to May.

Milwaukee Roentgen Ray Society
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. L. A. Nash, 572 Lowry Medical Arts Bldg., St. Paul 2, Minn. Meets three times annually, once at time of State Med. Assn., and in spring and fall.

Mississippi Radiological Society
Secretary, Dr. John W. Evans, 621 High Street, Jackson 2, Miss. Meets third Thursday of each month at the Rotisserie Restaurant at 6:30 P.M.

Nassau Radiological Society
Secretary, Dr. Joseph J. La Vine, 259 North Grand Ave., Baldwin, N. Y. Meets second Tuesday of the month in February, April, June, October and December.

Nebraska Radiological Society
Secretary, Dr. R. W. Blanchard, 1216 Medical Arts Bldg., Omaha, Nebr. Meets fourth Thursday of each month at 6 P.M. at Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. Stanley M. Wyman, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Harvard Club.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. Harold W. Jacox, 622 W. 168th St., New York 32, N. Y. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement.

Northeastern New York Radiological Society
Secretary, Dr. John F. Roach, Albany Hospital, Albany, N. Y. Meets on the second Wednesday of October, November and March at the University Club, Albany. Annual meeting in June to be announced.

Northern California Radiological Club
Secretary, Dr. G. A. Fricker, Sacramento County Hospital, Sacramento, Calif. Meets at dinner last Monday, every second month, except June, July and August.

Ohio State Radiological Society
Secretary, Dr. Willis S. Peck, 2001 Collingwood Blvd., Toledo, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. John R. Danstrom, Medical Arts Bldg., Oklahoma City, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. J. Richard Raines, 214 Medical-Dental Bldg., Portland 5, Oregon. Meets monthly from October to June on the second Wednesday of each month at 8:00 P.M. at the University Club.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport.

Philadelphia Roentgen Ray Society
Secretary, Dr. George P. Keefer, American Oncologic Hospital, Philadelphia 4, Pa. Meets first Thursday of each month, at 5 P.M., from October to May in Thompson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary, Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Radiological Section, Baltimore Medical Society
Secretary, Dr. H. Leonard Warres, 2337 Eutaw Place, Baltimore 17, Md. Meets third Tuesday each month, September to May, inclusive.

Radiological Section, Connecticut Medical Society
Secretary, Dr. William A. Goodrich, 85 Jefferson St. Hartford 6, Conn. Meetings are held bi-monthly.

Radiological Section, Medical Society of the District of Columbia
Secretary, Dr. U. V. Wilcox, 915 Nineteenth St., N. W., Washington 6, D. C. Meets Medical Society Library, third Thursday of January, March, May and October at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr Roy G. Giles, Temple, Texas.

Radiological Society of Greater Cincinnati
Secretary, Dr. Harry K. Hines, 2508 Auburn Ave., Cincinnati 19, Ohio. Meets monthly from September to June on first Monday of each month at 7:30 P.M. at the Cincinnati General Hospital.

Radiological Society of Hawaii
Secretary, Colonel Alexander O. Haff, M.C., Tripler Army Hospital, Honolulu, T. H. Meets third Friday of each month at Tripler Army Hospital.

Radiological Society of Kansas City
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

Radiological Society of New Jersey
Secretary, Dr. Nicholas G. Demy, 912 Prospect Avenue, Plainfield, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

Richmond County Radiological Society
Secretary, Dr. W. F. Hamilton, Jr., University Hospital, Augusta, Ga.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. Robert J. Bloor, 260 Crittenden Blvd., Rochester, N. Y. Meets last Monday of each month, September through May, at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr. Mid-Summer Conference, Shirley-Savoy Hotel, Denver, Colo., August 7, 8 and 9, 1952.

St. Louis Society of Radiologists
Secretary, Dr. Francis O. Trotter, Jr., 634 N. Grand Blvd., St. Louis 3, Mo. Meets fourth Wednesday each month, except June, July, August and September.

San Antonio-Military Radiological Society
Secretary, Dr. Hugo F. Elmendorf, Jr., 730 Medical Arts Bldg., San Antonio 5, Texas. Meets Brook Army Medical Center Officers Mess first Monday of each month.

San Diego Radiological Society
Secretary, Dr. Rex Uncapher, 7720 Girard Ave., La Jolla, Calif. Meets first Wednesday of each month at the University Club.

San Francisco Radiological Society
Secretary, Dr. I. J. Miller, 2680 Ocean Avenue, San Francisco 27, Calif. Meets quarterly.

Section on Radiology, California Medical Association
Secretary, Dr. Calvin L. Stewart, 2330 First Ave., San Diego 1, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

SOUTH BAY RADIOLOGICAL SOCIETY
Secretary, Dr. Ford Shepherd, 526 Soquel Avenue, Santa Cruz, Calif. Meets second Wednesday each month.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Frère, Newell Hospital, Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

TEXAS RADIOLOGICAL SOCIETY
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Next meeting: San Antonio, Texas, January 23 and 24, 1953.

UNIVERSITY OF MICHIGAN DEPARTMENT OF ROENTGENOLOGY STAFF MEETING
Meets each Monday evening from September to June, at 7:00 P.M. at University Hospital.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

UTAH STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

VIRGINIA RADIOLOGICAL SOCIETY
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

WASHINGTON STATE RADIOLOGICAL SOCIETY
Secretary, Dr. John N. Burkey, 555 Medical-Dental Bldg., Seattle 1, Wash. Meets fourth Monday of each month from September through May.

WESTCHESTER RADIOLOGICAL SOCIETY
Secretary, Dr. Walter J. Brown, Northern Westchester Hospital, Mt. Kisco, N. Y. Meets on third Tuesdays of January and October and on two other dates to be announced.

WISCONSIN RADIOLOGICAL SOCIETY
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-RAY STUDY CLUB OF SAN FRANCISCO
Secretary, Dr. Charles E. Duisenberg, Palo Alto Clinic, 300 Homer Ave., Palo Alto, Calif. Meets third Thursday at 7:45 P.M., January to June, Lane Hall, Stanford University Hospital; July to December, San Francisco Hospital.

CUBA, MEXICO AND CENTRAL AMERICA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

SOCIEDAD MEXICANA DE RADIOLOGIA Y FISIOTERAPIA
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

SOCIEDAD RADIOLÓGICA PANAMEÑA
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86, Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 P.M.
Medical Members' meeting, on third Friday in each month at 5:00 P.M., 32 Welbeck St., London, W 1.

FACULTY OF RADIOLOGISTS
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

SECTION OF RADIOLOGY OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets third Friday each month at 4:45 P.M. at the Royal Society of Medicine, 1 Wimpole St., London.

CANADIAN ASSOCIATION OF RADIOLOGISTS
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

SECTION OF RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

AUSTRALIAN AND NEW ZEALAND ASSOCIATION OF RADIOLOGISTS
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. deG. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179 B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

SOUTH AMERICA

ASOCIACION ARGENTINA DE RADIOLOGIA
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, JUNTA CENTRAL, BUENOS AIRES
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL LITORAL, SEDE, ROSARIO
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL SUR, SEDE, LA PLATA
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL CENTRO, SEDE, CORDOBA
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DEL NORTE, SEDE, TUCUMAN
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

SOCIEDAD ARGENTINA DE RADIOLOGIA, FILIAL DE CUYO SEDE, MENDOZA.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

SOCIEDADE BRASILEIRA DE RADIOLOGIA MEDICA
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

SOCIEDADE BRASILEIRA DE RADIOTERAPIA
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9:00 P.M. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

SOCIEDAD COLOMBIANA DE RADIOLOGIA
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.

SOCIEDAD PERUANA DE RADIOLOGIA
Secretary, Dr. Julio Bedoya Paredes, Apartado 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Société Française d'Electro-Radiologie Médicale, and its branches: Société du Sud-Ouest, du Littoral Méditerranéen, du Centre et du Lyonnais, de l'Ouest, de l'Est, et d'Alger et d'Afrique du Nord
Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX°, France.

Ceskoslovensk společnost pro rëntgenologii a Radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Deutsche Roentgen-Gesellschaft
Secretary, Dr. Peter Kröker, (22a) Essen-Helsingen, Westpreussenstrasse 21. Meets annually in different towns.

Societa Italiana dr Radiologia Medica
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

India

Indian Radiological Association
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India.

AMERICAN ROENTGEN RAY SOCIETY

1952 Annual Meeting

In further reference to the coming meeting of the American Roentgen Ray Society to be held at the Shamrock Hotel, Houston, Texas, September 23–26, 1952, it has been suggested by the Local Committee that those who plan to drive to Houston might like to make reservations during the time of the meeting at one of the attractive tourist courts near The Shamrock. The following list of tourist courts has been furnished by the Committee as being very desirable and all are air-conditioned.

Sun Valley Hotel Courts, 1310 Old Spanish Trail, Houston, Texas (Sun Valley will have two penthouses completed by the time of the meeting)

Plaza Courts, 1700 Old Spanish Trail, Houston, Texas

Crestwood Tourist Hotel, 9001 Main, Houston, Texas

Holiday Motel, 10319 Main, Houston, Texas

Buffalo Inn Hotel, 9051 Main, Houston, Texas

COURSE IN GASTROINTESTINAL ROENTGENOLOGY

The University of Minnesota will present a continuation course in Gastrointestinal Roentgenology for Radiologists from October 20 to 25, 1952. The course will be presented at the Center for Continuation Study on the University campus and will cover all aspects of roentgenologic examination of the gastrointestinal tract. The distinguished visiting faculty members will include: Dr. Olle Olsson, Professor, Department of Diagnostic Roentgenology, University of Lund, Lund, Sweden; Dr. Richard R. Schatzki, Chief, Department of Roentgenology, Mt. Auburn Hospital, Cambridge, Massachusetts; Dr. Frederic E. Templeton, Professor, Department of Radiology, University of Washington Medical School, Seattle; Dr. Paul C. Swenson, Professor, Department of Radiology, Jefferson Medical School, Philadelphia, Pennsylvania; and Dr. Leon Schiff, Associate Professor, Department of Medicine, University of Cincinnati College of Medicine, Cincinnati, Ohio. On Wednesday, October 22, the Annual Leo G. Rigler Lecture will be presented by Dr. B. R. Kirklin, Professor, Department of Radiology, Mayo Foundation, Rochester. The course will be presented under the direction of Dr. Leo G. Rigler, Professor and Head, Department of Radiology and Physical Medicine, and the remainder of the faculty will include members of the clinical and full-time faculty of the University of Minnesota Medical School and the Mayo Foundation.

REFRESHER COURSE ON MALIGNANT DISEASE

A week's course on the diagnosis and treatment of malignant disease will take place between October 6 and 10, 1952, to mark the official opening of the new building to house the facilities of the British Columbia Cancer Institute.

Guest speakers will include: Sir Stanford Cade, K.B.E., C.B., F.R.C.S., M.R.C.P., London, England; Professor B. W. Windeyer, M.D., B.S., F.R.C.S., F.F.R., London, England; D. Simeon T. Cantril, Director, Tumor Institute, Swedish Hospital, Seattle, Washington; Dr. Franz Buschke, Associate Director, Tumor Institute, Swedish Hospital, Seattle, Washington; Dr. O. H. Warwick, Executive Director, National Cancer Institute of Canada; Mr. H. M. Parker, M.Sc., F. Inst. P., Director Radiological Sciences Department, General Electric Co., Richland, Washington.

Application should be made to Dr. A. M. Evans, Director of the British Columbia Cancer Institute, 2656 Heather Street, Vancouver 9, B. C., not later than September 22, 1952. Tickets of admission will be supplied.

RADIOLOGICAL HEALTH TRAINING PROGRAM

The Public Health Service is sponsoring a radiological health program. One phase of this program is the series of short training courses which are conducted at the Environmental Health Center in Cincinnati, Ohio. These courses are free of tuition, and are offered to qualified applicants. The primary objective of the radiological health training courses is to assist health department employees and key personnel in other governmental or private organizations in achieving an understanding of the hazards and problems related to roentgen rays, radioelements, neutron fluxes, and particle accelerators. This training is designed for professional people who are concerned with radiological health problems in their respective fields. Candidates should have a degree in medicine, engineering, or science (physical or biological).

The Radiological Health Training consists of three units or courses of two weeks each,

namely: Basic, Intermediate, and Advanced, respectively. Completion of the Basic Course (or equivalent training) is a prerequisite for the Intermediate Course, and completion of the Intermediate Course (or equivalent training) is a prerequisite for the Advanced Course. All three courses may be taken consecutively as a six-week unit, or the Basic and Intermediate Courses may be taken consecutively as a four-week unit, or any course may be taken individually, providng entrance requirements are fulfilled.

The Basic Course provides training in the theory of radiation and radiation detecting instruments, the calibration and use of these instruments, the detrimental effects of radiation, the means of shielding and protection against radiation and permissible radiation exposure levels.

Basic Courses are scheduled as follows: October 6–17, 1952; January 19–30, 1953; April 20–May 1, 1953.

The Intermediate Course provides training at a more advanced level. This course is designed for those who have had the equivalent of the Basic Course and covers area and personnel monitoring, the radioassay of water, food, sewage and biological samples, and the operation, maintenance, and repair of radiation detection instruments.

Intermediate Courses are scheduled as follows: October 20–31, 1952; February 2–13, 1953; May 4–15, 1953.

An advanced Course is being presented for professional personnel who are concerned in particular with *occupational* radiological health problems. In this course, the present and probable future applications of radiation in industry and certain institutions are discussed. The radiation phenomena, associated health hazards, recommended protection principles, and applied instrumentation are also covered. The Advanced Course is offered to persons who satisfactorily have completed the Intermediate Course, or an equivalent training program.

The Advanced Course is scheduled for: February 16–27, 1953.

Further details and information can be obtained by writing: Chief, Radiological Health Training Section, Public Health Service, Environmental Health Center, 1014 Broadway, Cincinnati 2, Ohio.

AWARD TO WILLIAM D. COOLIDGE

The first award of the K. C. Li Medal for meritorious achievement in advancing the science of tungsten has been made to Dr. William D. Coolidge, director emeritus of the General Electric Research Laboratory in Schenectady and x-ray consultant to the company. Dr. Coolidge retired in 1944 as a vice-president and the director of research for the General Electric Company. The Li Award, consisting of a gold medal and $1,000, was established in 1948 through a permanent fund donated by Mr. K. C. Li and will be given every two years. Mr. Li, who discovered tungsten in China, one of the world's largest producers of high grade tungsten ore, is chairman of the board of the Wah Chang Corporation, a firm which produces and processes tungsten products.

AWARD TO EDITH H. QUIMBY

Dr. Edith H. Quimby, of the Department of Radiology, College of Physicians and Surgeons, Columbia University, has been awarded the second Jagadish Bose Memorial gold medal by the Indian Radiological Association. Dr. Quimby's memorial lecture was entitled "Recent Developments in Radiation Dosimetry."

RADIOLOGICAL SECTION OF THE BALTIMORE MEDICAL SOCIETY

At a recent meeting of the Radiological Section of the Baltimore Medical Society, the following officers were elected for the current year: *Chairman*, Dr. Richard B. Hanchett; *Secretary-Treasurer*, Dr. H. Leonard Warres, 2337 Eutaw Place, Baltimore 17, Maryland.

Meetings are held on the third Tuesday of each month, September to May, inclusive.

CHICAGO ROENTGEN SOCIETY

The newly elected officers of the Chicago Roentgen Society as of April, 1952, to April, 1954, are as follows: *President*, Dr. Benjamin D. Braun; *Vice-President*, Dr. Roger A. Harvey; *Secretary-Treasurer*, Dr. Elbert K. Lewis, 6337 South Harvard Avenue, Chicago, Illinois.

NEW YORK ROENTGEN SOCIETY

The following, having been duly elected the officers of the New York Roentgen Society for the year 1952–1953, will take office on September 1, 1952: *President*, Dr. John L. Olpp, Tenafly, New Jersey; *Vice-President*, Dr. Irving Schwartz, New York, New York; *Secretary*, Dr. Harold W. Jacox, 622 West 168th Street, New York 32, New York; *Treasurer*, Dr. Jacob R. Freid, New York, New York.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

CONSOLIDATED INDICES. Volume III. AUTHOR AND SUBJECT: 1943–1947 (Vol. 49–58), of the AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY. Compiled under the direction of the Publication Committee and the Editorial Office of the American Roentgen Ray Society. Cloth. Price, $12.50. Pp. 292. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1952.

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY, in presenting Volume III of the Consolidated Indices, covering the five year period from 1943 to 1947, Volumes 49–58, inclusive, has made a real contribution to radiology and all branches of medicine interested in the vast amount of material which has appeared in these volumes of the JOURNAL.

Those who have collaborated in the preparation of Volume III are to be complimented on the excellence of this index. Not only have the titles of each article been indexed, but each article and volume have been indexed page by page in much the same manner as textbooks are indexed, thus adding to the completeness of the index. Under a given subject, the name or names of the authors appear so that if one desires to consult a particular article by a given author, the information is readily accessible. There is no separation of authors and subjects, but the authors appear throughout the index in their proper alphabetical order. The volume numbers of the AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY appear in bold face Arabic type, rather than in the Roman numerals used in previous volumes of the Consolidated Indices, and a slightly larger size of type has been used in this index.

The index has been compiled in a way that is not only usable but permits the securing of the wanted information in a minimum amount of time. Most people do not appreciate what a tremendous amount of knowledge and effort are necessary in the preparation of a volume such as this. Its final appearance must be a source of satisfaction to those who have made this index possible.

The publisher and printer are also to be complimented on the excellence of this volume.

EUGENE P. PENDERGRASS, M.D.

ANGIOCARDIOGRAPHY. ANNALS OF ROENTGENOLOGY. Volume XX. By Charles T. Dotter, M.D., Assistant Professor of Radiology, Cornell University Medical College; Assistant Attending Radiologist, The New York Hospital; and Israel Steinberg, M.D., Assistant Clinical Professor of Radiology and Medicine, Cornell University Medical College; Assistant Attending Radiologist and Physician to Out-patients, The New York Hospital; etc. Cloth. Price. $16,00. Pp. 304, with 252 illustrations. Paul B. Hoeber, Inc., 49 East 33rd Street, New York 16, New York, 1951.

It is fitting that some fifteen years after the initial clinical application of angiocardiography in this country, the first monographic publication on the subject should be co-authored by one of the original workers. And it is the reviewer's considered opinion that the present authors and the publisher have done an excellent job of preparing an atlas which probably could not have been done as well by any other team in the world.

Technique is covered in the first fifty pages. In this section, as elsewhere in the book, the authors report primarily on methods they themselves have used. This is natural and proper but one is disturbed that descriptions of techniques used elsewhere are meager or lacking. There is bare mention, for example, of the biplane serial roentgenography practiced in Sweden, which is a logical and important development. The injection procedure was thoroughly studied by Robb and Steinberg in their early work and no changes are reported. However, a minor suggestion is that instrument sterilization in the roentgen department is not universally as successful as apparently the authors find it. Reactions, in the reviewer's experience, are fewer when the instruments are thoroughly cleaned by operating room personnel.

The normal angiocardiogram is described in sixty pages and thoroughly illustrated by roentgenograms and tracings. This is a most valuable section which will prove very helpful to beginner and experienced alike. Normal variations in the roentgen anatomy of the heart cannot be described too extensively. The great majority of the illustrations, and probably the text, concern adults. Perhaps this has been the nature of the available material. Since angiocardiography is practiced so often in infants and children, some information about differences, if any, would be useful.

The section on syphilitic aortitis and aneurysm is particularly well done. This material, which has been published previously by the authors, also presents careful measurements of the normal aorta. It is thought provoking that a normal aorta may exceed the average by 30 per cent. The authors properly emphasize the errors involved in the diagnosis of syphilitic aortitis when conventional methods are used. However, in these days of rapid antibiotic treatment, it is unlikely that many patients will be subject to angiocardiography before therapy is applied.

There are adequate sections on rheumatic, arteriosclerotic, hypertensive, pulmonary and miscellaneous acquired heart disease which are most useful for the study of roentgen anatomy. To more intelligently interpret the conventional examination, it is unlikely that one would often make an angiocardiogram to establish a diagnosis of cardiac aneurysm but it is nice to see the condition illustrated. As the authors note, the angiocardiogram might be necessary in the differentiation of cardiac tumor. An exception in this group might be constrictive pericarditis since clinical data and conventional roentgenography are not always convincing.

The section on non-cyanotic congenital heart disease also is illustrated largely from adults and might deserve further consideration in regard to children. The information afforded by angiocardiography is critically evaluated. The literature is examined carefully, particularly in regard to whether previous reports were sound. Certainly there will be no quarrel with most of the conclusions reached. The reviewer freely admits, for example, that he has reported on clinically typical but pathologically unproved cases. This seemed necessary in order to build up a literature just as many of the authors' cyanotic cases are unproved except in terms of what was noted during a Blalock procedure. The present monograph therefore does a much needed job by examining earlier opinions in the light of more extensive experience. However, some conclusions are dogmatic. It is doubtful, for example, that most surgeons would prefer angiocardiography to retrograde aortography in dealing with coarctation of the aorta.

The chapter on cyanotic congenital heart disease is reasonably complete and is well illustrated. Indeed, in a field where no one case seems to be exactly like the last, the authors' material, augmented as it is from the files of the Johns Hopkins Hospital and others, is as varied as can be expected. To this reviewer, there seems to be too much of an effort to exploit angiocardiography. The statement that the procedure should be routine preoperatively would be challenged in many clinics. It is questionable whether following a skillful catheterization, the increased morbidity is justified in the "routine" case. Furthermore, the demonstration of intracardiac shunts through an examination of contrast material concentrations is subject to considerable error, particularly when the potential technical deficiencies are not fully comprehended.

Chapters on mediastinal tumors, pulmonary tumors and pulmonary disease complete the book very adequately. Practically in any condition in which one would like to see the angiocardiographic appearance, at least one illustration will be found. One would quibble only with the authors' enthusiasm for the method. They say that, in pulmonary tumors, from the diagnostic standpoint, angiocardiography ranks with bronchoscopy. This must be challenged. As long as histology is the basis of medical procedure, a technique that must be interpreted cannot, in this reviewer's opinion, rank with one which permits inspection of the lesion and yields tissue for examination. This is not to question the value of angiocardiography when bronchoscopy is unrevealing or equivocal.

As a monograph on angiocardiography, this text will probably not be excelled for many years. It is obviously prepared by enthusiastic experts. The tendency to the limitation of the authors' horizon to their own contributions, even though the bibliography is complete, and the minimizing of the difficulties of angiocardiographic interpretation can be explained on this basis. As a contribution fitting angiocardiography into the understanding of cardiovascular

physiology, however, the text lacks broadness and perspective.

The authors are to be congratulated on their illustrations and tracings. The publisher has done excellently in reproducing what must many times have been very difficult subjects.

Marcy L. Sussman, M.D.

Röntgendiagnostik des Herzens und der grossen Gefasse. Von Prof. Dr. Erich Zdansky, Vorstand des Zentral-Röntgeninstitutes am allgemeinen Krankenhaus in Wien. Zweite, erweiterte Auflage. Cloth. Price, $19.50. Pp. 434, with 294 illustrations. Springer-Verlag, Mölkerbastei 5, Wien, 1949.

This second enlarged and in parts re-written monograph, well written in German, represents an up to date treatise on all roentgenological means of diagnosis in diseases of the heart and the large vessels. Great emphasis is laid on roentgenoscopy and many diagrams illustrate the roentgenoscopic findings. Orthodiagraphy is considered the method of choice for determining the correct size of the heart and as superior to heart measurements from teleroentgenograms. Roentgen kymography is considered an interesting method of examination, the results of which should be interpreted with caution.

Angiocardiography is limited to only six pages, which seems a rather meager treatment of it, explained by the author as due to lack of experience with the method and unavailability of the most recent literature. Twenty pages dealing with heart measurements seems a relatively large number, as does eighteen pages concerning the heart and physical exercise.

The chapters dealing with atrophy, hypertrophy and dilatation of single heart chambers are well worth studying. The pathological changes in valvular diseases stress the typical findings and the lack of positive roentgen signs in early or minimal cases. All other cardiac diseases with roentgen signs are mentioned and described.

It would seem that thirty pages on congenital heart diseases is not quite adequate at the present state of development of roentgen diagnostic means and considering the necessity of ruling in or out the possibility of cardiac surgery. There is no mention of the classical book of Taussig on congenital heart disease. The modern American literature does not seem to have been available, except to a small extent.

The aorta and its abnormal changes receive a very comprehensive description comprising about one-sixth of the book.

Twenty-five pages are given to an apparently very complete list of the European literature, especially the German and Austrian, while there appears to be a very incomplete listing of the many recent contributions of the American literature (up to 1949).

The illustrations and diagrams are good, and the book is attractively made up. It can be recommended to radiologists, cardiologists and physicians interested in cardiology who have a reading knowledge of German.

H. W. Hefke, M.D.

Roentgen Examinations in Acute Abdominal Diseases. By J. Frimann Dahl, M.D., Ph.D., Chief of Roentgen Department, Ullevål Hospital, Oslo, Norway. Cloth. Price, $10.50. Pp. 323, with 305 illustrations. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1951.

This book gives a detailed discussion of the roentgen examination of the abdomen in so-called "acute" abdominal diseases. The recommended technical procedures are elaborate and painstaking. The author regards roentgenoscopy as so important that it should be done even when the patient cannot be moved from his bed. Films with the patient standing erect are of great importance even when lateral recumbent films with horizontal rays are made. The analysis of the soft tissue shadows of the abdomen is detailed and excellent, particularly concerning the detection of smaller amounts of fluid.

A great deal of space is naturally given to the discussion of "stenosis" of both the small and the large intestine, including ileus, and the part played by plain films, particularly those made with horizontal rays, and by barium studies. The author emphasizes that barium is not dangerous in the small intestine and should be used in the presence of an obstruction when necessary. The section dealing with the Miller-Abbott tube, however, is inadequate.

The book is profusely illustrated. This serves to emphasize the fact that distention of various loops of small intestine with gas, "meteoristic loops," can result from many different conditions which may be easily confused. In general, the illustrations are adequate, but some are too small and in this reviewer's copy some seem smudged, suggesting careless printing. Some of

the cuts extend to the edge of the page. This technique is often seen in commercial printing; it saves space on the page and is a good idea which should have been used in medical publications before this.

The English is in general adequate. Occasional terms are unusual or unfamiliar, e.g., "torqued dermoid cyst." This, however, does not detract from the basic value of this work. This book clearly shows the careful study the author has given to the problem of abdominal diagnosis, and cannot fail to have a stimulating effect upon the reader.

Ross Golden, M.D.

Radiologia Austriaca. Herausgegeben von der Österreichischen Röntgen-Gesellschaft. Band IV. Cardboard. Price, $6.00. Pp. 207, with numerous illustrations. Urban & Schwarzenberg, Wien IX/71, Frankgasse 4, 1951.

This fourth volume of the year book of the Austrian Roentgen Society is dedicated to Robert Kienböck on the occasion of his eightieth birthday. The volume differs from the preceding three in that most of its sixteen papers deal with personal observations of the seventeen authors presenting them. Summarizing reviews and purely didactic or speculative papers, which have been abundant in previous volumes, are absent from the present year book. Nine papers deal with radiotherapy problems, five with roentgen diagnosis, one with radiation biology and one with roentgen physiology. The summarized proceedings of the Fourth Congress of the Austrian Roentgen Society (Graz, May 22 to 24, 1950) are appended.

Gerhart S. Schwarz, M.D.

Pathology of the Fetus and the Newborn. By Edith L. Potter, M.D., Ph.D., Associate Professor of Pathology, Department of Obstetrics and Gynecology, The University of Chicago; Pathologist, The Chicago Lying-in Hospital; Chief Pathologist, the Chicago Department of Health. Cloth. Price, $19.00. Pp. 574, with 601 illustrations. The Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, Illinois, 1952.

Here at long last is a much needed book on a long-neglected subject. It is difficult to refrain from predicting that "Pathology of the Fetus and the Newborn" by Dr. Edith L. Potter will long remain as a landmark in the literature of this most important subject. It will be welcomed by every obstetrician, pediatrician and pathologist who has ever been puzzled and distressed by an unexplained fetal or infant death. In all honesty this will include every physician in these specialties.

Even a cursory glance through the table of contents and later through the profusely and beautifully illustrated text will assure the reader that his hopes have in large part been realized. Whatever deficiencies may become apparent will be due more to the general lack of information on the subject than to any failure on the part of the author to cover the field. The opening chapters discuss the prenatal development of the fetus and placenta, abortion and the causes of fetal and infant death. Following a chapter detailing the postmortem examination, separate headings cover the subjects of prematurity, anoxia, trauma, infections, malformations, tumors and multiple births. The remainder of the text is divided into chapters covering the pathology of the various organs and organ systems. Each chapter concludes with a well selected bibliography.

A detailed analysis of this outstanding book in a review article is obviously impossible. Apparent at once, however, is intense interest and devotion of the author who has dedicated her efforts to a study of the dead infant in the hope that means may be found that others might live. Such studies involve not merely stark anatomical details but rather the physiological factors of growth, development and adaptation beginning with conception. Such knowledge, not the technical skill of performing an autopsy, is essential for the interpretation of the findings. A knowledge of embryology, obstetrics and pediatrics must be combined with a keen mastery of anatomy, physiology and chemistry. Those who know the many contributions of Dr. Potter in these fields will understand the keen insight which her approach to the pathology of the fetus and newborn permits.

It is impossible to single out for special discussion any one chapter of this text. Suffice it to say that this book is a *must* item for the library of every obstetrician, pediatrician and pathologist. Congratulations should also be offered to the publishers for their part in the production of a faultlessly printed and beautifully illustrated work.

Harold C. Mack, M.D.

PHYSIOLOGY OF THE EYE. CLINICAL APPLICATION. By Francis Heed Adler, M.A., M.D., F.A.C.S., William F. Norris and George E. de Schweinitz Professor of Ophthalmology, School of Medicine, University of Pennsylvania, and Consulting Surgeon, Wills Hospital, Philadelphia. Cloth. Price, $12.00. Pp. 709, with 319 illustrations including 2 in color. C. V. Mosby Company, 3207 Washington Boulevard, St. Louis, Missouri, 1950.

Physiology of the Eye is a completely new and comprehensive volume on ocular physiology, which is exceptionally well written and fills a serious void in teaching literature for ophthalmologists.

The material is as recent as any text could be and covers the essential physiology very well. The author, whose interests have tended toward physiology, utilizes his basic knowledge to advantage as this is a useful clinical addition.

As stated before, much new material has been incorporated, for instance, in the chapter on the cornea. Here Dr. Adler has included the work of Dr. V. E. Kinsey, collaborating with Dr. Cogan in Boston on their extensive research work in corneal chemistry and physiology.

The chapter on ocular circulation is well written and can be used for clinical interpretation. The following chapter on ocular motility could be easily accepted as a monograph. There are fine chapters on the retina, photochemistry, visual pathways, and entoptic and allied phenomena.

The book is authentic well written, and will serve as the basic book until the author finds it necessary to re-write it.

A. D. RUEDEMANN, M.D.

EYES AND INDUSTRY. Formerly INDUSTRIAL OPHTHALMOLOGY. By Hedwig S. Kuhn, M.D., Industrial Ophthalmologist, Hammond, Indiana. Second edition. Cloth. Price, $8.50. Pp. 378, with 151 illustrations including 3 color plates. C. V. Mosby Company, 3207 Washington Boulevard, St. Louis 3, Missouri, 1950.

This book, the second edition by the Secretary of the Committee on Industrial Ophthalmology, is well written. The author's deep interest in the eye problems of industry are manifested throughout the entire book.

Although little has been written about these problems except injuries and compensation, Dr. Kuhn has broadened the scope of the book by adding several new chapters.

There is a chapter on visual testing in industry and a complete chapter by Dr. Albert Snell on injuries and compensation. New material has been added in regard to epidemic conjunctivitis, a proper protection program.

There is definite need for a book in this broad field of ophthalmology and this latest edition adequately does the job.

A. D. RUEDEMANN, M.D.

RECOMMENDATIONS FOR WASTE DISPOSAL OF PHOSPHORUS-32 AND IODINE-131 FOR MEDICAL USERS. National Bureau of Standards Handbook 49. Issued November 2, 1951. Paper. Price, 10 cents. Pp. 11. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. (Foreign remittances must be in U. S. exchange and should include an additional one-third the publication price to cover mailing costs.)

With the increasing use of radioactive isotopes by industry, the medical profession, and research laboratories, certain minimal precautions must be taken to protect the users and the public. The recommendations in this handbook represent what are believed to be at present the best available opinions on the subject.

While continuous study is being made to eliminate the uncertainty regarding permissible radiation exposure levels, particularly for ingested radioactive materials, the handbook gives the soundest figures now known. If, in the future, these figures can be improved upon, appropriate corrections will be issued. The handbook was prepared by the National Committee on Radiation Protection, and the Subcommittee on Waste Disposal and Decontamination of this organization is carrying on further work in the field.

As the problem of the disposal of radioactive wastes varies over such wide limits, depending upon the usage to which the isotopes are put, the committee has decided to issue individual reports dealing with particular conditions. In the expectation that disposal of the greater part of phosphorus-32 and iodine-131 isotopes will be by sewer, the handbook considers permissible concentrations from the point of view of safety to the general community and more especially to sanitation workers and sewage plant personnel. It contains practical and easily fol-

lowed rules of disposal practice for specified isotopes.

Control and Removal of Radioactive Contamination in Laboratories. National Bureau of Standards Handbook 48. Issued December 15, 1951. Paper. Price, 15 cents. Pp. 24. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. (Foreign remittances must be in U. S. exchange and should include an additional one-third the publication price to cover mailing costs.)

This handbook gives detailed information on laboratory procedures designed to minimize the possibility of any accident involving radioactivity and to minimize the effects if such accidents do occur. As part of the program of the National Committee on Radiation Protection for establishment of radiation safety procedures, the handbook was prepared by the Subcommittee on Waste Disposal and Decontamination.

In addition to including a number of general safety precautions, the handbook contains specific recommendations and discussions intended primarily for the guidance of such users of radioactive isotopes as universities, hospitals, and industrial concerns. Wherever practical, recommendations are presented separately for different groups of isotopes.

Contamination of the person or of laboratory areas and equipment is a problem of fundamental importance to everyone working with radioactive isotopes. Constant vigilance must be maintained by every user not only to prevent contamination but also to contain its spread. The primary concern in this regard is always the protection of workers in the area from the health hazards of potentially dangerous radiations, but the maintenance of uncontaminated equipment and laboratories is also important if precise and reliable results are to be obtained. The handbook discusses permissible levels of contamination as well as decontamination procedures for the skin, clothing and bedding, laboratory tools and glassware, floors, work benches, hoods, etc. It also outlines emergency procedures.

BOOKS RECEIVED

Lehrbuch der Röntgendiagnostik. Von H. R. Schinz, W. E. Baensch, E. Friedl, E. Uehlinger nebst Beiträgen von E. Brandenberger, A. Brunner, U. Cocchi, N. P. G. Edling, J. Eggert, F. K. Fischer, M. Holzmann, H. Krayenbühl, Å. Lindbom, E. Lindgren, G. A. Preiss, S. Welin, A. Zuppinger. Fünfte, völlig neu bearbeitete und vermehrte Auflage. 3. Lieferung. Skelett. Paper. Price, DM 82.-/$19.50. Pp. 538, with 731 illustrations. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart, Germany (Grune & Stratton, Inc., New York, New York), 1951.

X-Ray Interpretation. By H. Cecil H. Bull, M.A., M.B., M.R.C.P., Honorary Consulting Radiologist to the Royal Waterloo Hospital, London, and the General Hospital, Southend-on-Sea. With a chapter on Radiography of the Head by James W. D. Bull, M.A., M.B., M.R.C.P., D.M.R., Assistant Radiologist, St. George's Hospital; Radiologist, Maida Vale Hospital for Nervous Diseases; Assistant Radiologist, National Hospital. Second edition. Cloth. Price, $5.50. Pp. 406, with 287 original illustrations by the author. Oxford University Press, 114 Fifth Avenue, New York 11, New York, 1951.

Diagnostic Roentgenology. Volume I. By Ross Golden, M.D., Editor, Professor of Radiology, the College of Physicians and Surgeons, Columbia University; Director of the Department of Radiologic Service, The Presbyterian Hospital, New York. Renewal pages. The Williams & Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore 2, Maryland, 1952.

Tumors of the Eye. By Algernon B. Reese, M.D., D.Sc.(Hon.), F.A.C.S., Attending Ophthalmologist and Pathologist, Institute of Ophthalmology, Presbyterian Hospital, New York; Ophthalmologist to Memorial Center for Cancer and Allied Diseases, New York; Clinical Professor of Ophthalmology, College of Physicians and Surgeons, Columbia University. Cloth. Price, $20.00. Pp. 574 with 283 illustrations. Paul B. Hoeber, Inc., Medical Book Department of Harper & Brothers, 49 East 33rd Street, New York 16, New York, 1951.

Thoracic Aortography. With Special Reference to Its Value in Patent Ductus and Arteriosus and Coarctation of the Aorta. Acta radiologica, Supplement 89. By Gunnar Jönsson, Bror Brodén and Johan Karnell. Paper. Price, Swed. Cr. 30:- Pp. 176, with 72 illustrations. Acta Radiologica, Stockholm 2, Sweden, 1951.

The Abnormal Pneumoencephalogram. By Leo M. Davidoff, M.D., Director of Neurological Surgery, Beth Israel Hospital, New York City; Clinical Professor of Neurosurgery, New York University-Postgraduate Medical School; and Bernard S. Epstein, M.D., Associate Radiologist, The Jewish Hospital of Brooklyn, Brooklyn, N. Y., and Instructor in Clinical Radiology, Long Island College of Medicine. Cloth. Price, $15.00. Pp. 506, with 289 illustrations. Lea & Febiger, Washington Square, Philadelphia 6, Pennsylvania, 1950.

Clinical Urography. An Atlas and Textbook of Roentgenologic Diagnosis. By William F. Braasch, M.D., Emeritus Consultant in Urology, Mayo Clinic; Emeritus Professor of Urology, Mayo Foundation, Graduate School, University of Minnesota; and John L. Emmett, M.D., Consultant in Urology, Mayo Clinic; Associate Professor of Urology, Mayo Foundation, Graduate School, University of Minnesota. Cloth. Price, $25.00. Pp. 736, with 1361 illustrations. W. B. Saunders Company, West Washington Square, Philadelphia, Pennsylvania, 1951.

An Atlas of General Affections of the Skeleton. By Sir Thomas Fairbank, D.S.O., O.B.E., M.S., Hon. M.Ch.(Orth.), F.R.C.S., Consulting Orthopaedic Surgeon and Emeritus Lecturer in Orthopaedic Surgery, King's College Hospital; Consulting Surgeon, Hospital for Sick Children, Great Ormond Street; Emeritus Consulting Surgeon, Lord Mayor Treloar Orthopaedic Hospital, Alton; Honorary Consultant (Orthopaedic) to the Army. Cloth. Price, $10.00. Pp. 411, with 184 illustrations. Williams & Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore 2, Maryland, 1951.

Die Dystrophie. By Professor Dr. Med. Heinrich Berning, Oberarzt der I. Med. Universitätsklinik, Hamburg-Eppendorf (Direktor Prof. H. H. Berg). Cardboard. Price, DM 18.-. Pp. 197, with 34 illustrations and 15 tables. Georg Thieme, Diemershaldenstrasse, 47, Stuttgart, Germany (Grune & Stratton, Inc., New York, New York), 1949.

Radiologia Austriaca. Herausgegeben von der Österreichischen Röntgen-Gesellschaft. Band V. Cardboard. Pp. 195, with numerous illustrations. Urban & Schwarzenberg, Wien IX/74, Frankgasse 4, 1952.

Nouveau Traité d'Électro-Radiothérapie. By L. Delherm. Comité de Rédaction: Dr. R. Coliez, Pr. A. Desgrez, Pr. P. Lamarque, Pr. A. Strohl. Secrétaires Généraux: A. Devois, H. Fischgold, R. Angammarre. In three volumes. Cloth. Price, 16,000 fr. for the three volumes. Volume I, pp. 1068; Volume II, pp. 954; Volume III, pp. 753, with numerous illustrations and tables. Masson et Cie., 120, boulevard Saint-Germain, Paris VI^{e}, France, 1951.

Electrophoresis in Physiology. By Lena A. Lewis, Ph.D., Research Division, Cleveland Clinic, Cleveland, Ohio. Fabrikoid. Price, $1.85. Pp. 66, with several illustrations and tables. Charles C Thomas, Publisher, 301 East Lawrence Avenue, Springfield, Illinois, 1950.

The Story of the Adaptation Syndrome (Told in the Form of Informal, Illustrated Lectures). By Hans Selye, M.D., Ph.D. (Prague), D.Sc. (McGill), F.R.S. (Canada), Professor and Director of the Institut de Médecine et de Chirurgie expérimentales, Université de Montréal. Fabrikoid. Price, $4.50. Pp. 225, with numerous illustrations. Acta, Inc., 5465 Decarie Boulevard, Montreal 29, Quebec, Canada, 1952.

Results of Treatment of Cancer in Saskatchewan 1932–44 (inclusive). By T. A. Watson, M.B., Ch.B., D.M.R., Director of Cancer Services, Saskatchewan Cancer Commission. Published by permission of the Minister of Public Health of Saskatchewan, 1951. Paper. Pp. 68. A limited number of these booklets are available free of charge from Secretary, Saskatchewan Cancer Commission, Grey Nuns' Hospital, Regina, Canada.

Annual Report on the Results of Radiotherapy in Carcinoma of the Uterine Cervix. Sixth Volume. Statements of Results Obtained in 1943 and Previous Years (collated in 1949). Sponsored by The British Empire Cancer Campaign, London, The Donner Foundation, Philadelphia, The Cancerföreningen, Stockholm, The World Health Organization. Editorial Committee: Dr. J. Heyman, Editor, Stockholm, Dr. M. Donaldson, London, Dr. Joe V. Meigs, Boston. Editorial Office: Stockholm 60, Sweden. Paper. Pp. 172. P. A. Norstedt & Söner, Tryckerigatan 2, Stockholm 2, Sweden, 1951.

First Report on Institutional Research Grant of the American Cancer Society. Paper. Pp. 258. American Cancer Society, Inc., 47 Beaver Street, New York 4, New York, 1951.

Eleventh Semiannual Report of the Atomic Energy Commission. January, 1952. Paper. Pp. 211, with numerous illustrations. United States Government Printing Office, Washington, D. C.

The Merck Index of Chemicals and Drugs. An Encyclopedia for the Chemist, Pharmacist, Physician, and Allied Professions. Sixth edition. Cloth. Price, $7.50 for the regular edition and $8.00 for the thumb-index edition. Pp. 1167. Merck & Co., Inc., Rahway, New Jersey, 1952.

Vol. 68, No. 3

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

Head

Schurr, P. H. Cerebral angiography in abscess of the temporal lobe. *Brit. J. Surg.*, Sept., 1951, *39*, 156–165.

The purpose of this paper is to describe the part which cerebral angiography can play in the diagnosis and management of cases with abscess of the temporal lobe. In the last six years angiography has been performed at Oxford in 30 patients who were found to be suffering from cerebral abscess. In 12 cases the abscess was situated in the temporal lobe, and it is these which have been studied. In no case did the method fail to demonstrate the site of the lesion.

The angiographic appearances in the anteroposterior view are a shift of the anterior cerebral artery to the opposite side, and in many cases a shift of the great vein of Galen in the same direction. The middle cerebral artery is usually elevated in its first part, especially when the abscess is anteriorly situated; it may not appear to be raised at all by those abscesses which are far back. In the lateral projection, there is elevation of the middle cerebral group of vessels and an area in the temporal lobe may appear relatively avascular. The normal distance of these vessels above the horizontal portion of the carotid siphon is taken to be 1 cm., and the degree of displacement is the increase in this distance. The shape of the distortion may give further information as to the precise location of the abscess in the middle fossa, the greatest displacement or stretching being above the abscess.

The differential diagnosis is discussed at length. The value of repeated angiographic examinations to follow the progress of the abscess is emphasized. And, finally, it is the author's opinion that displacements of the middle cerebral group are shown to be roughly proportional to the total volume of the abscess.—*W. C. McCarty, Jr., M.D.*

Lindfren, Erik, and Di Chiro, Giovanni. Suprasellar tumours with calcification. *Acta radiol.*, Sept., 1951, *36*, 173–195.

The two lesions which are the most frequent causes of suprasellar calcification are the craniopharyngiomas and the suprasellar gliomas. It has been estimated that there is roentgenologically demonstrable calcification in about 55–60 per cent of craniopharyngiomas and in about 50 per cent of the suprasellar gliomas. The calcification in the craniopharyngiomas is of two types, cystic and nodular. Approximately 33 per cent of the calcified cases are of the cystic type.

The calcification of the suprasellar gliomas is nodular in character. Encephalography is usually the only means by which differentiation between a craniopharyngioma and a suprasellar glioma can be made. In the latter, the third ventricle is altered in shape and pushed backwards. In craniopharyngiomas the third ventricle is pushed backwards and upwards and the tumor produces a bulging into the anterior-inferior part of the third ventricle between the chiasmal and infundibular recesses.

Occasionally the capsule of a pituitary adenoma may calcify so that it may simulate the cystic calcification of the craniopharyngioma. However, the calcification in the latter is more apt to be located anteriorly and upwards while that of the pituitary adenoma is posterior, projecting the line of the dorsum sellae. The authors estimate that calcification in the pituitary adenoma is seen in only about 3 per cent of cases.

Suprasellar meningiomas rarely show calcification and when they do the calcification is rather characteristic. It consists of small elements which are uniform and arranged close together. The calcification looks almost homogeneous and is located more anteriorly than that of the craniopharyngiomas or suprasellar gliomas.

The calcification in chordomas is dense and is composed of a linear component (calcified capsule). They are more parasellar than suprasellar in position. Moreover, chordomas usually destroy the dorsum sellae, the clivus and the apex of the petrous bone.

Suprasellar cholesteatomas showing calcification are infrequent. The calcification is much like the nodular type seen in the craniopharyngiomas.

The fine curvilinear calcification of the anuerysms of the internal carotid artery and its branches usually has such a typical appearance that there is no doubt as to the diagnosis.—*Mary Frances Vastine, M.D.*

Hodes, Philip J., Pendergrass, Eugene P., and Dennis, John M. Cerebellopontine angle tumors; their roentgenologic manifestations. *Radiology*, Sept., 1951, *57*, 395–406.

This is a comprehensive report of 183 patients operated on for a cerebellopontine angle tumor. Of the group there were 73 per cent eighth nerve tumors, 10.4 per cent meningiomas, 9 per cent gliomas, 4 per cent cholesteatomas and a few miscellaneous tumors.

Adequate roentgenograms will give evidence of cerebellopontine angle tumors in a high percentage of the cases. The authors emphasize the value of the Towne position and the posteroanterior view but lateral views and Stenvers' position are also of value. They call attention to the fact that the petrous pyramids and internal auditory meatuses vary remarkably from patient to patient and are also not necessarily symmetrical bilaterally.

Of 134 true eighth nerve tumors, 93 per cent were acoustic neurinomas while 7 per cent were acoustic neurofibromas of the von Recklinghausen type. The roentgen evidence of these eighth nerve tumors

consists of bone erosion of the petrous apex and internal auditory canal. The authors have graded the extent of erosion into six groups with group 1 (10 per cent of all eighth nerve tumors) showing no evidence of erosion and group 6 showing complete destruction of the petrous apex. Most of the cases were in groups 3 and 4 where there was definite roentgen evidence of bone erosion.

Occasionally, cerebellopontine angle tumors can only be demonstrated by pneumoencephalography where pressure may be demonstrated on the third ventricle and aqueduct, and possibly the fourth ventricle.

Of the 10.4 per cent of cerebellopontine angle tumors which were meningiomas, one-third showed increased bone density in the cerebellopontine area. This finding was not observed in any other type of tumor. The cerebellopontine angle meningiomas which do not produce bone may erode in a manner similar to that of the eighth nerve tumors.

Nine per cent of the series of patients had an angle glioma and 4 per cent had an angle cholesteatoma. These tumors gave similar roentgen findings to those noted in auditory nerve tumors but attention is called to concomitant sphenoidal wing atrophy and petrosal erosion in some cases of cholesteatoma.

The history and physical findings play a very important role in differentiating tumors which are located in the cerebellopontine angle. The patients with cholesteatoma gave a history of long illness while those with gliomas had symptoms for a relatively short time.

Localizing roentgen evidence of acoustic nerve tumors was demonstrated in 85 per cent while meningiomas and cholesteatomas were localized in 50 per cent. Only 1 case of glioma showed petrous erosion.—*C. A. Stevenson, M.D.*

Epstein, Bernard S. Angiographic demonstration of an anatomic variation in the position of the transverse dural sinuses. *Radiology*, Sept., 1951, *57*, 407–410.

Two instances of anomalous position of one of the transverse dural sinuses as seen on a cerebral angiogram are described. The anomaly consisted of a medial displacement of the affected transverse sinus which occurred on the left side in one patient and on the right side in the other. In one of the patients another sinus, believed to be the occipital, appeared to be dilated.

Both cases were postoperative (common carotid-internal jugular anastomosis). However, the operation was not responsible for the anomalous appearance because in one instance the variation was demonstrated preoperatively and in both cases the anomaly was demonstrated within an hour after operation. The anomaly is probably of congenital origin.—*McClure Wilson, M.D.*

Ray, Bronson S., and Dunbar, Howard S. Thrombosis of the dural venous sinuses as a cause of "pseudotumor cerebri." *Ann. Surg.*, Sept., 1951, *134*, 376–386.

The recognition of a clinical syndrome characterized by increased intracranial pressure and clear cerebrospinal fluid without an intracranial neoplasm has puzzled the surgeon since it was first reported by Quincke (1893). Clinically, these cases present headache, papilledema, increased cerebrospinal fluid pressure, and occasionally transient palsies and convulsions.

The condition was referred to by Nonne as "pseudotumor cerebri." In some cases it is associated with infection of the middle ear and mastoid process or with recent head injuries or the postpartum state, but in half the cases no definite lesion is demonstrable. The etiology may possibly be some defect in the production or absorption of the cerebrospinal fluid.

The authors present the results of a study by sagittal sinus venography in 4 patients having this peculiar syndrome. Briefly, the method consists of the injection of 35 per cent diodrast into the anterior portion of the superior sagittal sinus via a catheter through a small midline burr hole. Normally the contrast medium passes backward through the superior sinus to the torcular Herophili and thence through both transverse sinuses into the internal jugular veins. The cerebral veins and other dural sinuses will fill if there is obstruction. Normal venous pressure in the sinus amounts to 100–150 mm. of saline, which is measured before and after jugular compression.

In 3 patients the authors were able to localize obstruction due to thrombosis in the sagittal sinus and to demonstrate increased pressure enabling the surgeon to remove the thrombus. There was subsequent decrease in pressure in the sinus with definite improvement in the clinical picture.

The fourth patient gave a history of purulent discharge from the right ear for two weeks. Roentgenograms showed evidence of acute right mastoiditis. A venogram after mastoidectomy revealed an infected thrombosis in the transverse sinus, with complete obstruction of the right transverse sinus just lateral to the torcular Herophili and a small left transverse sinus. The venous pressure was 320 mm. The opaque medium entered some of the veins of the scalp and the superior cerebral veins. This type of lesion has been referred to as "otitic hydrocephalus."—*T. R. Long, M.D.*

Psenner, L. Über röntgenologische Veränderungen bei Arachnitis optico-chiasmatis. (Roentgenographic changes in arachnoiditis of the optic chiasm.) *Wien. klin. Wchnschr.*, Sept. 7, 1951, *63*, 679–680.

In 2 cases, clinically diagnosed as arachnoiditis

of the optic chiasm, the author noted an enlarged optic canal with an irregular contour and osteoporotic defects in the adjacent bone. These changes may be differentiated from meningioma since the latter cause a more or less typical hyperostosis in the region of the optic canal.—*Joseph Zausner, M.D.*

Liess, G. Die Linea innominata des Schädels, ihr anatomisches Substrat und ihre Bedeutung für die Diagnostik der Orbita-Tumoren. (The linea innominata of the skull, its anatomical basis and its significance in the diagnosis of tumors of the orbit.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Aug., 1951, *75*, 165–168.

On the posteroanterior roentgenogram of the skull, there is a very dense line running almost vertically through the lateral third of the orbit. This line begins in the region of the superior margin of the orbit and extends mesially to the lower border of the orbit. In standard textbooks, this line has been designated as the linea innominata and has been said to correspond to the greater wing of the sphenoid bone. Stenvers believes that this line corresponds to that part of the sphenoid bone where two compact layers superimpose in the anterior lateral border of this bone. More recently Cregg (*Radiology*, August, 1950) has found that the linea innominata is produced by a tangential projection of the temporal surface of the greater wing of the sphenoid.

The author was surprised when he could find no bony ridges in the skull to correspond to the linea innominata as it is projected on the roentgen film. He inserted a metal wire in the deepest portion of the temporal fossa, which placed the wire precisely upon the suture between the frontal process of the zygomatic bone and the greater wing of the sphenoid. After taking a roentgenogram, the linea innominata was visualized, and immediately lateral and parallel to it could be seen the metal wire. Accordingly, it is concluded that the anterior border of the greater wing of the sphenoid in the region of the suture between this bone and the frontal process of the zygomatic bone is projected as the linea innominata. Also, it is seen that the linea innominata as a projection line of the anterior border of the greater wing of the sphenoid belongs to the lateral wall of the orbit. Since the latter is very thin, and cannot be demonstrated on the roentgen film, the significance of the linea innominata for the diagnosis of lesions in the orbit is obvious.

Three illustrative cases are presented.

In summary, great significance is attached to the visualization of the linea innominata. If this line is interrupted in its course, is faint in outline, or fails to visualize, a pathological process in the region of the lateral wall of the orbit should be seriously suspected.—*Samuel Richman, M.D.*

Berry, Harrison M., Jr. Radiopaque materials in the roentgenographic interpretation of periodontal lesions; preliminary report. *J. Am. Dent. A.*, Sept., 1951, *43*, 278–284.

This paper is a preliminary report on the use of radiopaque materials in the roentgenographic interpretation of periodontal lesions.

The roentgenogram becomes an important factor in diagnosis and prognosis of periodontal disease by revealing the amount of alveolar bone loss, the distribution of the remaining bone, the type of alveolar bone loss, particularly the rapidity with which resorption of bone takes place. It also aids in the evaluation of treatment through periodic examinations.

Radiopaque material was used as a means of producing visual demonstration of pocket depth in an attempt to determine if there is any correlation with alveolar bone destruction as determined roentgenographically. A basic roentgen technique using bitewing films was employed, and the opaque material used was absorbent cotton saturated with lipiodol and tucked into the pocket with a probe. The number of clinical trials to date is inadequate to draw any conclusions on whether lipiodol will outline the full depth of all pockets, and investigations are continuing.—*A. B. Smith, M.D.*

Goldenberg, Raphael R. The skull in Paget's disease. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 911–922.

In this paper the author first gives the historical background of Paget's disease with emphasis on osteoporosis circumscripta. In regard to the incidence of osteoporosis circumscripta he quotes Kasabach and Gutman who concluded that, while the general age distribution in osteoporosis circumscripta was the same as that in Paget's disease, the peak age incidence in the former apparently falls two decades earlier. The material which the author studied does not seem to bear out this age distribution. This may be due to the fact that his material happened to include specimens of many older people.

A detailed description of the gross pathology of the skull in osteoporosis is given. The roentgenographic picture, he thinks, may be accounted for by the presence of areas of local absorption associated with increased vascularity. The gross pathology of the skull in more advanced cases of Paget's disease is also discussed, likewise the histopathological characteristics of both conditions.

The roentgenographic features of Paget's disease depend upon the underlying pathological processes of bone destruction and bone repair. Roentgenographic examinations are of the greatest importance since, in the absence of pertinent clinical findings, they may reveal instances of osteoporosis circumscripta with involvement of the calvarium at an early stage. A frequent characteristic of the skull in

Paget's disease is that, while the outer table is porotic the inner table is sclerotic. It is well known that porosis of the outer table is a phase of the disease, but the inner table has been incorrectly designated as a normal inner plate. It has been stated that the outer table and the diploë are primarily and most severely affected, while the inner table shows little if any change. The author believes that actually this is not true in Paget's disease, where the entire skull shows involvement. Guard must be taken against confusing the rarefaction of osteoporosis circumscripta with the rarefied areas of bone destruction caused by tumors seen in the thickened and sclerotic calvarium of a pagetic skull.

Goldenberg's review of the literature failed to disclose a single instance of osteoporosis circumscripta cranii which was diagnosed clinically. Clinical signs were absent in all cases. The majority of patients were asymptomatic. The paucity of clinical complaints serves to differentiate between the early phase of Paget's disease (osteoporosis circumscripta) and the later stages (with sclerotic foci and thickening of the skull), during which clinical signs and symptoms become more frequent.

An accurate estimate of the frequency of sarcomatous degeneration in Paget's disease presents a difficult problem, since the majority of reported cases have occurred in patients with advanced skeletal involvement, and few instances of Paget's disease without complications have been reported. Sarcoma may develop simultaneously in several foci in Paget's disease. The type of sarcoma present in the disease is not necessarily an osteogenic sarcoma. A fibrosarcoma may develop instead. Cases of coexisting multiple myeloma and Paget's disease have been reported. The author recently exhibited illustrations of 2 cases in which a giant cell tumor without new bone formation developed in connection with Paget's disease of the skull. The prognosis he thinks is better in these giant cell tumors than in osteogenic sarcomas. The usual life expectancy after the development of sarcoma is about one year.

Goldenberg thinks that the diagnosis of osteoporosis circumscripta is possible and may be made as much as eight years before the appearance of Paget's disease elsewhere in the skeleton.—*R. S. Bromer, M.D.*

MOORE, SHERWOOD. Morgagni's syndrome and brain tumors. *J. Neurosurg.*, Sept., 1951, *8*, 480–481.

In the course of a study of idiopathic, symmetrical hyperostosis of the skull which is a feature of the condition known under such varying names as l'hyperostose frontale interne, Stewart-Morel syndrome, hyperostosis frontalis interna, metabolic craniopathy and Morgagni's syndrome, special attention was attracted to associated and complicating disease.

In 10,064 individuals, 627 females and 55 males had hyperostosis. The incidence of tumor in female hyperostotics was 6.22 per cent and in the controls (patients without hyperostosis), 6.14 per cent. For the males, the values were 2.27 per cent and 7.86 per cent respectively.

Except for the meningeal fibroblastoma there is no significant relationship between hyperostosis and intracranial neoplasm.

A table relating intracranial neoplasm and hyperostosis is included.—*J. D. Reeves, M.D.*

SCHROEDER, A. H., ARANA, R., and SAN JULIÁN, J. Hematoma subdural optoquiasmático. (Subdural optochiasmatic hematoma.) *An. Fac. de med. de Montevideo*, 1951, *36*, 17–20.

A case is presented of a man, aged thirty-two, who complained of progressive loss of vision in the right eye for one year. For six months there had also been a diminution of vision in the left eye, and the patient had a sensation of seeing a cloud before this eye. Transient frontal and nuchal headaches were present, but there was no nausea or vomiting. Examination revealed right optic atrophy with loss of light reflex. The left optic nerve was normal, but vision was diminished.

Right carotid arteriography showed the terminal portion of the carotid siphon to be depressed backward and downward. Ventriculography revealed a slight upward compression of the frontal horn of the right lateral ventricle. Upon surgical exploration a subdural hematoma near the optic chiasma was evacuated.—*C. M. Nice, M.D.*

MOORE, RALPH C. Cerebral arteriography in general hospital practice. *Radiology*, Oct., 1951, *57*, 487–499.

Serialographic cerebral arteriograms, although more informative and accurate, are not an absolute necessity for adequate cerebral angiography. Using the single film technique and the percutaneous injection of 15 cc. of 35 per cent diodrast into the internal carotid artery, the author has investigated 54 cases of suspected intracranial lesions. Eight vascular lesions were discovered including arterial aneurysms, arteriovenous aneurysms, congenital arteriovenous malformations, and hemangiomas. A few examples of intracranial neoplasms are presented from this series showing how the procedure aids in the diagnosis of neoplasm and also in the differential diagnosis of glioblastoma multiforme, meningioma, and hemangioma.—*M. B. Goodwin, M.D.*

RAY, BRONSON S., DUNBAR, HOWARD S., and DOTTER, CHARLES T. Dural sinus venography. *Radiology*, Oct., 1951, *57*, 477–486.

Although five reports were found in the literature pertaining to the injection of contrast medium into

the dural sinuses, there has been no systematic study of this method of examination. In studying the intracranial venous system the authors have injected (1) 35 per cent diodrast into the anterior third of the superior sagittal sinus by means of a ureteral catheter, and (2) 70 per cent diodrast retrogradely into the internal jugular vein by means of a catheter introduced via the basilic vein of the arm. Jugular compression does not alter the pattern in the first method while it is required in the second method. The exact extent of normal filling obtainable by the second method has not yet been determined, hence further discussion will be confined to the first method. This method normally fills the posterior superior sagittal, transverse, and sigmoid sinuses and the internal jugular veins. The other dural sinuses normally do not fill but occasionally contrast medium may be visualized in the diploid and scalp veins. When obstruction is present, other channels will be filled, depending on the site of the obstruction. When 20 normal subjects were studied by this method, the generally quoted much greater frequency of right transverse sinus dominance was not substantiated. The superior sagittal sinus venous pressure may be readily obtained at the time of injection and is normally between 100 and 150 mm. of saline.

The procedure will demonstrate invasion and/or obstruction of a sinus by either a thrombus or neoplasm. In addition, if the sinus pressure is relatively low and there is complete obstruction by neoplasm, the sinus may be safely removed with the tumor. The lower sinus pressure indicates that the obstruction has progressed slowly enough for adequate collateral circulation to develop. If the obstruction is due to a thrombus, removal by means of a catheter is possible. Eighteen abnormal patterns were obtained showing (a) invasion of the superior sagittal sinus by meningioma (5 cases), sarcoma (2 cases) and metastatic carcinoma (1 case); (b) thrombosis of the superior sagittal sinus (3 cases); (c) invasion of a transverse sinus by meningioma (4 cases) and carcinoma (1 case); and (d) thrombosis of a transverse sinus (1 case).

Four patients having a symptom complex variously called pseudotumor cerebri, serous meningitis and otitic hydrocephalus all showed sinus thrombosis, 3 with thrombosis of the posterior third of the superior sagittal sinus and 1 of the transverse sinus, this last case following severe mastoiditis of the ipsilateral side.

The procedure has been performed on 38 patients with only 4 patients having complications. Extravasation of the contrast medium in 2 cases caused a severe headache which cleared in twenty-four hours. Serum pockets at the site of the wound in 2 cases responded to single needle aspiration.—*M.B. Goodwin, M.D.*

Feld, M., and Clément, J. La cisternographie. Technique. Indications. Résultats. (Cisternography: technique, indications, results.) *Presse méd.*, Oct. 24, 1951, *59*, 1396–1400.

Cisternography is derived from pneumoencephalography, not as a minor variation but as an autonomous roentgenologic procedure with its own circumscribed indications. Standard encephalography does not consistently visualize both ventricles and cisterns. The aim of cisternography is to delineate the morphology of the cisterns and to study their hydrodynamics through the timing of the cisternal transit. Elective filling of the basilar cisterns can be achieved either by injection on a tilt-table (Belloni) or by injecting in the sitting position either through the lumbar or suboccipital route. In the former, 10–20 cc. of air is introduced through the lumbar route with the patient in lateral decubitus and the table inclined at 15 degrees; the head of the patient is below the level of the lumbosacral cul-de-sac. An equal quantity of fluid is removed. The patient is placed in dorsal decubitus so that the air passes to the ventral aspect of the cul-de-sac. The head of the patient is supported in extension but not too marked. The table is then tilted to 40 degrees in the opposite direction so that the head is 50–60 cm. above the level of the feet. The air then fills the basilar cisterns. Five successive lateral roentgenograms are made at set intervals, 10, 30, 60 seconds, 5 and 10 minutes after the table is tilted. Good results are obtained regularly. This is the method ordinarily employed by the authors.

The basilar cisterns may be modified in permeability, shape and size. These are studied as well as filling defects. The indications for the procedure are chiasm and diencephalon (vegetative and endocrine) syndromes, extrinsic tumors of the chiasm decussation, ventricular hydrocephalus due to blockage of the cisterns.—*M. L. Sussman, M.D.*

Seaman, William B. Olfactory esthesioneuro-epitheliomas. *Radiology*, Oct., 1951, *57*, 541–546.

"Olfactory esthesioneuro-epithelioma" is the name given by Berger, Luc and Richard in 1924 to a nasal neurogenic tumor probably arising from the sensory cells of the olfactory mucosa. This is a relatively rare tumor having morphologic traits in common with a neuroepithelioma and a neuroblastoma.

Clinically it is a large, painless, polypoid intranasal mass, which bleeds easily and causes progressive nasal obstruction. Invasion of bone apparently is uncommon and, when it does occur, is a late manifestation. Recurrences have followed surgical removal in most instances. The tumor is markedly radiosensitive and irradiation is probably the best method of therapy. No exact appraisal of the radiocurability can be made since none of the published cases have been observed for an adequate period of time.

The author reports a case of olfactory esthesio-neuro-epithelioma occurring in a sixty-five year old male with a nine year history of nasal obstruction and frequent opistaxis. Three courses of roentgen therapy were given after surgical removal and to control local recurrences. Eventually there was metastatic spread to the cervical and mediastinal lymph nodes.—*A. W. Sommer, M.D.*

NECK AND CHEST

O'MALLEY, ROBERT D., PARSONS, WILLIAM BARCLAY, and BALL, ROBERT P. Intrathoracic goiter; surgical management and roentgenographic appearance. *Surg., Gynec. & Obst.*, Aug., 1951, *93*, 197–208.

The management of a selected group of patients with intrathoracic goiter is presented to illustrate the surgical features usually encountered.

The superior mediastinum remains widened for some time after the removal of a tumor mass. The authors' personal observations on serial roentgenograms of the chest suggest that it requires from six to twelve weeks for restitution to normal. The persistent widening appears to be due in part to the presence of edema and possibly slight hemorrhage in some cases. Edema alone would not be likely to persist more than two weeks. The silhouette of the mediastinum is greatly influenced by the degree of positive pressure exerted upon it by the expanded lungs. This molding effect of the lungs is produced gradually but effectively. It is probable that the apparent lag in restitution to normal of the mediastinal silhouette is dependent upon the molding effect of the expanded lungs rather than persistence of edema or hemorrhage.

It is emphasized that the arteries lie mesial to the large veins and are therefore less likely to contribute to the margin of the mediastinal silhouette.—*Mary Frances Vastine, M.D.*

KEARNS, JOHN E., DAVIS, HARWELL, JR., and BRAND, THEODORE R. Thyroid nodules. *Quart Bull., Northwestern Univ. M. School*, Fall, 1951, *25*, 240–244.

The authors reviewed 120 consecutive patients whose thyroids were investigated because of the presence of a nodule, and also reviewed a selected group of 25 patients with carcinoma of the thyroid. They believe from their findings that the single nodule goiter should be resected, especially in the male and in the child as it is often malignant.

The method of biopsy varies with the lesion but the nodule or nodules should be completely removed and in most instances is best done by lobectomy or subtotal resection. Frozen section is believed to be of little value. The histopathologic appearance of the tumor of the thyroid contributes little to the prognosis if the bizarre tumors are excluded. Careful gross examination of the tissue is thought to be of primary importance in diagnosis of malignancy of the thyroid.

The authors found that many of the cases showing single nodules clinically had multiple nodules on pathologic examination. Carcinoma of the thyroid was observed later in some patients who had a nodular goiter removed. Thus removal of the nodule is no insurance against malignancy.

Radical surgery was found to contribute to control of these lesions. They believe that a block dissection should be done.

The use of radioactive iodine is discussed. The uptake of radioactive iodine in the primary tumor is no indication as to how the metastatic foci will respond. They feel that the response may be altered by total thyroidectomy. They found that where the bony metastases have healed with ionizing radiation, there has been no recurrence in patients followed for three to four years. The true therapeutic value of the radioactive iodine, however, cannot be assessed at the present due to insufficient time of its use. The authors have a patient who has had a malignancy of the thyroid for thirty-five years and is clinically well despite the presence of the malignancy.—*C. W. Cooley, M.D.*

FRAZELL, EDGAR L., and DUFFY, BENEDICT J., JR. Hürthle-cell cancer of the thyroid; review of forty cases. *Cancer*, Sept., 1951, *4*, 952–956.

Hürthle-cell cancer of the thyroid is a relatively rare tumor, containing large, opaque, acidophilic cells which may be arranged in sheets or alveolar groups. The origin of these cells is controversial.

The incidence of Hürthle-cell cancer is reported as varying between 0.5 and 9 per cent of thyroid cancers. It comprised 10 per cent of the thyroid cancers at Memorial Hospital, New York.

The authors report 40 patients, 27 of them women, in whom a diagnosis of Hürthle-cell cancer was made. The median age was fifty years, the range extending from twenty-one to seventy-two years. The clinical findings were those of a slowly enlarging thyroid mass, usually for several years, thus paralleling the course of benign adenoma; in fact, in 17 cases subtotal thyroidectomies were done for goiter. In 4 cases metastases occurred before a primary tumor could be demonstrated. Local invasion was found in 10 cases, but spread to the cervical lymph nodes seems to be a feature observed chiefly in recurrent cases, as in 6 cases treated with primary radical neck dissection there were no demonstrable metastases. Metastases occurred to bones, cervical lymph nodes, lungs and other viscera, in descending order of frequency.

The authors discuss in detail the various methods of treatment. They believe that subtotal thyroidectomy is inadequate since there was recurrence in 14 of 17 cases so treated. Total removal of the affected

lobe would be preferable. Since in 6 previously untreated cases no metastases were found, radical neck dissection may not be necessary as primary treatment. Because of the high incidence of cervical lymph node involvement in inadequately treated patients (9 of 10 cases), radical neck dissection on the affected side should be done in all instances where there is residual or recurrent tumor.

External irradiation is of value in palliation of metastases and in one case caused disappearance of alleged lung metastases with minimal doses.

Prognosis depends on the stage of the disease. All cases with osseous metastases had vein invasion. Of the 40 patients reported, 18 are living without evidence of disease, but follow-up is short for many of them.—*H. J. Klos, M.D.*

Effler, Donald B., and Ballinger, Charles S. Complications and surgical treatment of hiatus hernia and short esophagus. *J. Thoracic Surg.*, Sept., 1951, *22*, 235–247.

Hiatus hernia is not usually thought of as a fatal or even an incapacitating disease. In reality the complications of the hernia are serious and occasionally fatal.

Hiatus hernia is commonly classified into three main groups.

1. The paraesophageal hernia
2. The pulsion type hernia
3. The short esophagus with thoracic stomach

The authors believe that a sharp distinction must be made between true hernias and thoracic stomach associated with short esophagus. This distinction is based on the belief that the etiology differs between the two groups as do the related symptoms, complications, and clinical cause. For clarity, the two groups are presented separately.

The authors classify the complications of hiatus hernia as follows: (1) bleeding, (2) peptic ulcer, (3) volvulus.

They believe that the presence of one or more of these complications is an indication for surgical repair.

They stress three separate categories of complications attributable to short esophagus: (1) stricture, (2) bleeding, (3) peptic ulcer.

Symptomatic short esophagus is a structure deformity. The generally unsatisfactory response to conservative measures have prompted more radical surgical approaches to the problem. Unless the structural defect is corrected permanently, any other form of therapy must be considered as merely palliative.

The techniques of repair of hiatus hernia and short esophagus, both simple and ulcerated, are given and discussed.—*T. C. Stansbury, Jr., M.D.*

Effler, Donald B., and Collins, E. N. Complications and surgical treatment of hiatus hernia and short esophagus with thoracic stomach. *J.A.M.A.*, Sept. 8, 1951, *147*, 305–308.

The authors point out that the least common of the hiatal hernias is that type associated with true short esophagus. It is also less commonly recognized by the clinician and roentgenologist than are the more obvious paraesophageal hernias.

The complications of the acquired short esophagus and its associated thoracic stomach are classified in three catagories:

(1) Bleeding—massive or occult
  A. Hematemesis
  B. Melena
(2) Peptic Ulcer
  A. With bleeding
  B. With perforation
(3) Stricture

Each of these is discussed in some detail.

The management of short esophagus has been primarily by the endoscopist and gastroenterologist and, in general, two methods of conservative therapy have been suggested: (1) dietary control with supplemental medication, and (2) use of bougies for the relief of stricture.

The surgical treatment for complicated short esophagus hernia is described and has been resorted to because prolonged hospitalization and intensive medical therapy have yielded poor results too frequently.

The authors emphasize the importance of recognizing short esophagus and its associated complications. Special roentgenological techniques are urged including examinations in the Trendelenburg position. They point out that inadequacy of medical therapy for short esophagus is largely due to the frequent erroneous diagnosis of duodenal ulcer. With early recognition of the entity and adequate medical therapy, the patient may be spared prolonged discomfort and serious complications.

When serious complications have ensued and the disease is refractory to therapy, the possibility of surgical relief must be considered. Even though symptoms may be relieved in many cases by intensive medical therapy, the program must be continued through life and it is felt that there is an excellent possibility that surgery will offer permanent relief in selected cases.—*R. D. Moreton, M.D.*

Kay, Earle B. Observations as to the etiology and treatment of achalasia of the esophagus. *J. Thoracic Surg.*, Sept., 1951, *22*, 254–270.

The pathology in achalasia is essentially a sphincter-like hypertrophy of the circular musculature of the terminal esophagus producing esophageal obstruction and secondary esophageal dilatation and hypertrophy above.

There is evidence to show that when there is degeneration, reduction, or absence of ganglion

cells in Auerbach's plexus a preponderance of sympathetic control develops. Muscular coordination is then impossible and the circular fibers become contracted and hypertrophied, causing esophageal obstruction with secondary esophageal dilatation above.

This terminal esophageal obstruction can be adequately relieved by dilatation or by severing the hypertrophied circular muscle in the terminal esophageal constriction.—*T. C. Stansbury, Jr., M.D.*

CARTER, JOHN P., ALRICH, E. MEREDITH, and DRASH, E. CATO. Spontaneous rupture of the esophagus; report of two patients treated surgically with survival. *Surgery*, Sept., 1951, *30*, 500–505.

Two cases of spontaneous rupture of the esophagus, with successful surgical repair, are reported. Both patients at first were suspected of having perforated peptic ulcer. In one, hydropneumothorax and in the other, pyopneumothorax developed during hospitalization. In one case instillation of a radiopaque medium (lipiodol) through a Levin tube disclosed leakage into the left pleural space just above the diaphragm. In the other case, while the patient was swallowing barium, the substance was seen to escape from the left anterior surface of the esophagus just above the cardia.

Pathologically, the finding in these cases is a longitudinal tear in the lower part of the esophagus, and no causative lesion can be demonstrated.

The first symptoms usually suggest some emergency state in the upper part of the abdomen, but subsequent symptoms involve the thorax.

Symptoms which should bring the possibility of this condition to mind are: severe vomiting following a debauch; pain which follows, rather than precedes, vomiting; severe prostration and continuous pain; epigastric pain extending to back or shoulder, usually to the left. A roentgenogram of the thorax should be made early; it may show air in the mediastinum and also hydropneumothorax. Swallowed opaque medium will leak into the pleural space or mediastinum.

A review of the literature showed only 13 other cases in which the outcome was successful.—*André Bruwer, M.D.*

WANGENSTEEN, OWEN H. A physiologic operation for mega-esophagus (dystonia, cardiospasm, achalasia). *Ann. Surg.*, Sept., 1951, *134*, 301–318.

The paper begins with a discussion of the susceptibility of the esophagus to injury by acid-peptic juice either by regurgitation or the presence of gastric mucosa in the esophagus. Cardiospasm, however, is not an acid-peptic linked disorder as evidenced by the lack of improvement following gastric resection alone.

From the pathologico-physiological standpoint, the term "dystonia" is more accurate than "cardiospasm" or "achalasia" in describing mega-esophagus. Atony of the proximal with hypertonus of the distal esophagus are the primary factors in the genesis of the disease. The absence of Auerbach's plexus in the esophageal wall may be an accompaniment of idiopathic esophageal dilatation.

A historical review of the various procedures used in an attempt to effect relief is given. Excepting the present procedure, only that of extramucosal myotomy of the distal esophagus is considered functionally satisfactory. The indication for operation thus far is failure of the condition to respond to dilatation.

The procedure discussed in this paper consists of (1) excision of a portion of the distal dilated esophagus along with the hypertonic esophagogastric juncture, (2) excision of the entire acid secreting portion of the stomach (to prevent acid-peptic erosion of the esophagus), (3) esophago-antral anastomosis, and (4) a Rammstedt type of pylorotomy to insure satisfactory emptying of the residual antrum which is vagotomized because of the procedure.

The approach is through a median supraumbilical incision extended with a median extrapleural sternotomy with a small T-bar added at the upper end, cutting laterally on both sides into the fourth intercostal space.

Other uses of the sternotomy incision are mentioned.

According to the author, all of the 7 patients operated on have done well. The dysphagia has been relieved and the size of the esophagus has been reduced. The results have been particularly striking in patients with a large, redundant, bag-like, atonic esophagus.

The concept of similarity between mega-esophagus hypertonic pyloric stenosis and megacolon as related types of functional disorder is presented.

Discussions follow the paper.

Several excellent drawings, diagrams and photographs are included.—*L. A. Pilla, M.D.*

COFFEY, J. H., and DRAVIN, I. Perforated esophageal ulcer. *Am. J. Digest. Dis.*, Sept., 1951, *18*, 285–286.

The authors report the case history of a fifty-four year old white male who had chronic duodenal ulcer with gastric retention and an unrecognized esophageal ulceration that terminated by perforation, peritonitis, and death.

The authors believe that repeated vomiting is probably the most important factor in the etiology of esophageal ulceration. These ulcera are often associated with hiatus hernia and with duodenal ulcers, particularly when the latter are obstructing. Hemorrhage is frequent and the incidence of perforation has been 14 per cent in some series. Abdominal perforation gives the usual signs of a ruptured

hollow viscus. Mediastinal perforation manifests itself by sudden severe precordial or epigastric pain, shock, and dyspnea. Later, the temperature and white blood cell count rise, and signs of pleural effusion develop. Roentgenograms of the chest may show air behind the heart, air in the upper mediastinum or pleural effusion.

It is important to diagnose mediastinal perforation early since treatment by thoracotomy and drainage has proved successful in some cases.—*W. H. Smith, M.D.*

Janker, R., and Hallerbach, H. Zur Querschicht-Untersuchung bei angeborenen Herzfehlern. (Transverse laminagraphy in congenital heart disease.) *Röntgen-Blätter*, Sept., 1951, *4*, 244–254.

Axial (transverse) laminagrams of 62 patients with various congenital heart defects were studied in an attempt to elicit further information concerning the position and size of the cardiac chambers and great vessels. Most of the films were exposed during angiocardiography, the sections being made through the level of the aortic arch and pulmonary arteries or at the atrial level, depending upon the type of congenital defect suspected. The films exhibit nicely the *gross* characteristics of the various portions of the heart and vessels in cross section.

Although the laminagrams obtained are interesting from an anatomical viewpoint it is doubtful that this method, which requires a special laminagraphic apparatus, will find widespread use in cardiac diagnosis.—*Harold Fulton, M.D.*

Newman, Walter, and Jacobson, Harold G. Bizarre pulmonary manifestations in heart disease. *Am. Heart J.*, Aug., 1951, *42*, 184–193.

The usual roentgenographic chest findings in cardiac disease are well known. For instance, in cardiac failure the appearance of congestive changes in the hila and pulmonary tissues, and pleural and interlobar effusions are easily recognized. There are, however, certain unusual manifestations of congestive cardiac failure, several examples of which are reported. Three cases represent bizarre roentgenologic findings of cardiac failure, and a fourth presents a peculiar location of a pulmonary infarct in a case of chronic heart failure.

In the first case, besides the usual signs of congestive failure, there were nodular densities in each hemithorax with one overlying the interlobar fissure between the upper and middle lobes, one along the right lateral chest wall, and one larger density seen adjacent to the midline in the right upper hemithorax. These densities were at first thought to represent metastatic deposits, but a left oblique film showed them to be interlobar collections of fluid which disappeared eight days later after appropriate therapy. The unusual location of these interlobar effusions may have been on the basis of a previous obliterative pleuritic process.

The second patient had congestive failure and edema involving all parts of the body from the neck down, more marked on the right. The roentgenogram showed the entire right hemithorax obscured by a homogeneous density which suggested a massive pleural effusion. Up to that time, the patient had been lying almost exclusively on his right side; he was requested to lie on his left side, and soon there was a more even distribution of the edema. A chest film forty-eight hours later showed almost complete disappearance of the right-sided homogeneous density, suggesting that it represented a large amount of fluid in the soft tissues overlying the right chest.

The third cardiac patient's chest film showed hilar engorgement, emphysema of the bases of the lungs, and nodular and linear reticulations in each upper lobe with "honeycombing" which suggested the presence of tuberculosis. The clinical examination for pulmonary tuberculosis yielded negative results. After one week of therapy for congestive heart failure, the upper lobe infiltrates disappeared. The rapid clearing of this supposed inflammatory process undoubtedly represented resolution of pulmonary congestion in an emphysematous individual in whom the congestive changes were limited to the upper lobes because of the emphysema of the lung bases.

The fourth patient exhibited the classical signs of congestive failure in the chest roentgenogram, and, in addition, there was a spheroid nodular density 3 cm. in diameter in the extreme right lung apex. The density was thought to represent either a superior sulcus tumor, aneurysm of the innominate artery, or an atypical pulmonary infarct. Autopsy proved it to be the latter, with the periprostatic venous plexus as a possible source. Since the majority of infarcts are triangular or pyramidal in shape, with a convex surface toward the heart shadow, and occur usually in the lower lobes (74 per cent of cases), the diagnosis was difficult to make antemortem.—*Harold Fulton, M.D.*

Breakey, Arnold S., Dotter, Charles T., and Steinberg, Israel. Pulmonary complications of cardiospasm. *New England J. Med.*, Sept. 20, 1951, *245*, 441–447.

The authors present a very interesting and convincing paper showing the association of cardiospasm and respiratory tract disease. They have studied a total of 63 cases having cardiospasm with associated pulmonary lesions of such varied character as chronic pulmonary fibrosis, pneumonia, lung abscess, bronchiectasis, atelectasis and acute asphyxia. The average age of these patients was 40.5 years.

In 39 per cent of the cases the initial presenting symptoms were referable to the pulmonary complication rather than to the primary esophageal disease

and dilatation. The authors point out that probably the contents of the dilated esophagus spill into the tracheal bronchial tree at night, more often entering the right main bronchus than the left.

Treatment of the pulmonary complication of course depends upon recognition of the esophageal spasm and treatment of the underlying abnormality. —*C. L. Hinkel, M.D.*

LAKE, RICHARD A. Pulmonary changes related to cardiospasm. *Ann. Int. Med.*, Sept., 1951, *35*, 593–599.

Although aspiration pneumonitis caused by esophageal overflow secondary to obstruction from neoplasm, stricture, diverticula or foreign body has been reported frequently in the literature, aspiration pneumonitis secondary to cardiospasm has rarely been recorded. The pulmonary complications resulting from basilar pneumonitis are abscess, bronchiectasis, atelectasis and interstitial pulmonary fibrosis.

The author reviewed 124 cases of cardiospasm and found 12 of these cases which showed pulmonary involvement. All but 1 had pulmonary symptoms which seemed definitely related to exacerbations of the cardiospasm. He found that in some of the cases the pulmonary symptoms subsided when the cardiospasm was relieved. He therefore believes that in cardiospasm the patient aspirates only small amounts of the esophageal overflow at a time and that the pulmonary changes appear in the later stages of the disease.

The possibility of pulmonary complications should always be considered in cardiospasm.—*F. M. Windrow, M.D.*

CLAGETT, O. THERON, and JAMPOLIS, ROBERT W. Coarctation of the aorta; a study of seventy cases in which surgical exploration was performed. *Arch. Surg.*, Sept., 1951, *63*, 337–348.

The authors report surgical intervention for the correction of coarctation of the aorta in 70 patients, the youngest being seven years of age and the oldest fifty. They feel that the optimal time for operation is between fifteen and twenty years of age, but patients should not be denied the benefits of surgical treatment because of advanced age, myocardial conduction defects, previous cerebrovascular accidents or previous congestive failure. In this series, there were 44 males and 26 females. Few or no symptoms were present in 42 of the patients. Fatigability, dyspnea on exertion, headache, tiredness or aching in the calves, and palpitation were the commonest complaints, followed in close order by cold feet, precordial distress, dizziness, tachycardia, and blurred vision.

Diagnosis is easy when the condition is thought of, all that is needed being a stethoscope, a sphygmomanometer and one's fingers. Elevated systolic and diastolic blood pressures were found in the arms, while the systolic pressure in the thighs was low. However, the diastolic pressure in the thighs was usually higher than normal. The commonest cardiac murmur was systolic over the base of the heart. Usually the intercostal arteries were so dilated as to be conspicuous. The electrocardiogram was nonspecific.

Notching of the inferoposterior margin of the ribs occurred in 65 out of the 70 patients, a hypoplastic aortic knob in 28, and an enlarged left ventricle in 27. Many of the roentgenograms showed dilatation of the left subclavian artery. Angiocardiography adds little in helping to establish the diagnosis and need not be used.

In 13 patients there were bicuspid aortic valves and in 8 there were cerebral aneurysms. Three patients had an associated patent ductus arteriosus.

Resection of the strictured segment and end-to-end anastomosis was carried out in the last 48 operable cases and is the operation of choice. The inoperability rate was 11.4 per cent, and the over-all mortality rate 7.1 per cent. No deaths occurred in the last 55 explorations.—*A. E. Childe, M.D.*

CAMPBELL, MAURICE, and SUZMAN, S. Transposition of the aorta and pulmonary artery. *Circulation*, Sept., 1951, *4*, 329–342.

This article reviews 25 cases of transposition of the aorta and pulmonary artery out of 400 cases of cyanotic congenital heart disease. Sixteen patients were under the age of five and 9 were between six and eighteen years of age. There were 5 deaths, all from the group under five years of age and 1 autopsy.

Varying degrees of disability were fairly constant. Cyanosis was as intense as in cases of Fallot's tetralogy and of slightly earlier onset. Polycythemia and clubbing were prominent, the latter often appeared as early as at the age of two to three years. A systolic murmur was constantly present, with a maximum in the pulmonary area. Thrill was infrequent. Twenty-five per cent had a diastolic murmur maximal in the pulmonic area. The most important physical sign was a loud booming or reduplication of the pulmonary second sound. Pulsations in this area were frequently visible or palpable. The heart was more enlarged than in cases of tetralogy of Fallot, the enlargement being mainly right ventricular. No cases had a deep pulmonary bay, 66 per cent had some concavity and 33 per cent had moderate to great convexity of the left upper heart border.

The most constant fluoroscopic and roentgenographic findings were dense mottled lung fields and enlarged pulsating pulmonary arteries indicating increased vascularity, a condition the authors refer to as pulmonary pleonemia. This is opposed to the decreased pulmonary arterial flow found in most cases of cyanotic congenital heart disease. The authors use the term pulmonary oligemia in refer-

ence to the latter. They feel that a deep central cyanosis, combined with pulmonary pleonemia, indicates either a partial or complete transposition.

The differential diagnosis between transposition and Eisenmenger's complex is the important one but the later onset of cyanosis and the minimal or absent pulmonary pulsations, together with the relatively normal lung fields in the Eisenmenger's complex should create little confusion.

Prognosis in infancy is frequently poor but cases with a relatively small heart and a large left to right shunt will often be seen in later childhood.

The authors report in detail 10 cases: 6 with catheterization, of which 2 had angiocardiography; 2 in which the diagnosis was made at operation; 2 additional cases of transposition with combined infundibular pulmonary stenosis with necropsies. In these the differential diagnosis from tetralogy of Fallot was difficult.—*C. E. Sherwood, M.D.*

Lippert, Karl M., Potozky, Henry, and Furman, Irvine K. Clinical significance of pleuropericardial cyst. *Arch. Int. Med.*, Sept., 1951, *88*, 378–386.

Pleuropericardial, or pleurocelomic, cysts have been infrequently reported, but appear to have a much higher incidence than the number of reports would seem to indicate. The etiology is poorly understood, but it is thought that they are probably caused by the failure of one of the primitive lacunas to merge with the others.

These cysts are usually asymptomatic but when large may cause pressure symptoms. They are usually difficult to differentiate from other intrathoracic lesions. These include teratomas and dermoids, lipomas, chondromas, lymphangiomas, sarcomas, pleural endotheliomas, calcified hematomas, metastatic carcinomas, secondary hydatid cysts, diaphragmatic hernia, and pleural effusion.

Surgical treatment is indicated when the cyst becomes so large as to cause dyspnea and pain, and when differential diagnosis fails to show conclusively the character of the tumor. Three case reports are presented.—*D. S. Kellogg, M.D.*

Bates, John C., and Leaver, Frank Y. Pericardial celomic cysts; presentation of five new cases and five similar cases illustrating difficulty of diagnosis. *Radiology*, Sept., 1951, *57*, 330–338.

Pericardial celomic cysts constitute a definite entity, probably originating on the basis of a failure of fusion of one of the primitive pericardial lacunae.

A total of about 38 cases, which satisfy the requirements for this diagnosis, have been reported since the first case was described by Dufour and Mourrut in 1929. The following findings, as determined by Bradford, Mahon and Grow, must be present before a diagnosis of pericardial celomic cyst can be made: (1) a thin-walled cyst; (2) clear fluid; (3) lining of endothelium or mesothelium that may look quite like epithelium. Thus, a positive diagnosis cannot be established roentgenologically. The condition must be taken into consideration, however, when a mass is visualized in the anterior chest, especially in either cardiophrenic sulcus. Dermoid cyst, lipoma, spindle cell endothelioma, adenocarcinoma, and eventration of the left hemidiaphragm are among the conditions which must be considered in differential diagnosis.

Five cases of pericardial celomic cyst in which the diagnosis was proved at operation are reported in detail by the authors. Five cases of other lesions are presented because of the similarity of the histories and roentgen findings to those in the 5 patients with celomic cysts.—*A. W. Sommer, M.D.*

Levene, George, and Kaufman, Seymour A. The roentgen diagnosis of pericardial effusion; with special reference to the appearance of the barium-filled esophagus and the cardiohepatic angle. *Radiology*, Sept., 1951, *57*, 373–383.

The roentgen diagnosis of pericardial effusion is difficult and no single sign is pathognomonic. Physical diagnostic signs point out the value of obliteration of the right cardiohepatic angle as of value but the authors state that the roentgen findings of an obtuse angle militates against the presence of an effusion.

Most observers agree that 300 cc. or less of pericardial fluid cannot be recognized by roentgen methods, but amounts over this volume will cause a bulging of the pericardial cavity which may be recognized by lengthening of the heart shadow (serial roentgenograms), increase in the transverse diameter as the effusion increases, obliteration of the normal auriculoventricular silhouette, decreased or absent pulsations, and a relatively small great vessel mass.

Any form of heart disease may produce an enlarged heart which may be confused with pericardial effusion. In right heart failure, the enlarged right ventricle pushes to the left and right and the protrusion to the right causes a wide or obtuse angle with the diaphragm. In pericardial effusion the accumulation of fluid forms an acute or small angle with the right side of the diaphragm, for the pericardium is fixed to the central tendon of the diaphragm and can only bulge.

Changes in intrathoracic pressure (Valsalva test) will alter the shape of an enlarged heart but will have no effect on pericardial effusion. A new sign reported by the authors is the typical smooth compression deformity of the barium-filled esophagus caused by the distended pericardium. This esophageal concavity is lower than the defect produced by an enlarged left auricle.—*C. A. Stevenson, M.D.*

KLASSEN, KARL P., ANDREWS, NEIL C., and CURTIS, GEORGE M. Diagnosis and treatment of superior-vena-cava obstruction. *Arch. Surg.*, Sept., 1951, *63*, 311–325.

The authors report 12 patients with superior vena cava obstruction. This is a syndrome characterized by venous distention and edema of the head, neck and upper extremities. Venous pressure determinations of both upper and lower extremities will substantiate the diagnosis, and venograms with simultaneous injection of 35 cc. of 70 per cent diodrast into the antecubital veins of both arms will demonstrate the location and degree of obstruction and show the collateral circulation.

Mediastinal decompression produced no improvement in a case of traumatic thrombosis of the vena cava. In 1 patient it was possible to section a ring-like constriction of the pericardium at the point of entrance of the vena cava and relieve the obstruction. In another there was occlusion of the superior vena cava and azygos vein secondary to lymphadenitis and mediastinitis. A vein graft between the azygos vein and the intrapericardial superior vena cava produced marked clinical improvement, and a subsequent venogram five months after operation showed continued patency of the graft. A fourth patient was found to have a mediastinal teratoma which was removed. Surgery was considered inadvisable in 1 patient who had a syphilitic aneurysm of the right innominate artery and ascending aorta.

There were 6 instances of primary intrathoracic malignant growth and deep roentgen therapy produced palliative relief in 5 of these patients.—*A. E. Childe, M.D.*

HANTELMANN, BR. Die Pericarditis calculosa im Kindesalter. (Pericarditis calculosa in childhood.) *Tuberkulosearzt*, Aug., 1951, *5*, 471–476.

Pericarditis in childhood is not rare, the etiology often being tuberculous. This is difficult to establish except when tuberculosis in other organs and a positive tuberculin test are found.

Two cases of calcifying adhesive pericarditis with severe cardiac embarrassment are described in 2 boys of fourteen and twelve years of age respectively. Dyspnea, ascites, pulsation of the jugular veins, enlarged liver and a positive tuberculin reaction were the prominent clinical findings in the first case. Roentgen examination revealed a widened heart shadow surrounded by a calcified plaque. The mediastinum was widened, with pulsation on both the right and the left border. Calcified mesenteric lymph nodes were found on a roentgenogram of the abdomen. The patient underwent a pericardectomy but died two weeks later from pneumonia.

The second case was suffering from an enlarged liver and ascites from his eighth year of age. On his first admission, at the age of ten, multiple skin tuberculides were noted and a culture from the ascitic fluid was positive for the tubercle bacillus. Multiple small tuberculous foci and thickening of the pleura bilaterally were found on a chest roentgenogram. The tuberculin test was positive. The ascites required frequent paracentesis. The heart was normal. Calcified mesenteric lymph nodes were seen on a roentgenogram of the abdomen. On readmission, two years later, at the age of twelve, it was found that the patient's condition had deteriorated and peripheral edema had appeared. A chest roentgenogram now showed extensive pericardial calcifications. Surgical removal of these resulted in marked improvement of the peripheral stasis.

The author emphasizes the importance of early diagnosis and mentions successful attempts to prevent the formation of adhesions by replacement of fluid in the pericardial sac by air or oil. In cases with fully developed adhesions causing circulatory embarrassment, early pericardectomy is recommended. —*K. E. Matzinger, M.D.*

ESGUERRA GÓMEZ, GONZALO. Importance of the relation between the anthropometric index and the transverse cardiac diameter for appraising the size of the heart. *Radiology*, Aug., 1951, *57*, 217–227.

The method of Ungerleider and Clark of checking the transverse cardiac measurement against the height and weight of the patient is believed to be very accurate. The author emphasizes the importance of taking into account the anthropometric index which is essentially an estimation of the area to which the heart must supply blood.

Although some cardiac hypertrophy might be expected among people living at high altitudes, the author found the average heart size at Bogota, Columbia, at an altitude of 8,660 feet above sea level, to be the same as at lower altitudes.

In obtaining average transverse cardiac measurements in children as well as adults, the author found a small negative deviation of the transverse diameter from nine to sixteen years of age. He attributes this to an excessive accumulation of fat during this age period. He states that, in the same way, a rapid loss of weight must produce a marked positive deviation.

Among eleven figures, the author includes a valuable reference nomogram for prediction of transverse diameter in children with a description of a proposed slide rule based on the conclusion that the transverse diameter of the heart is equal to twice the square root of weight divided by height ($D=2\sqrt{W.H}$).—*F. E. Seedorf, M.D.*

DRAKE, EUGENE H. Coronary sclerosis and pulmonary hypertension. *Ann. Int. Med.*, Sept., 1951, *35*, 600–607.

The author states that anything which increases the pulmonary blood pressure in patients suffering

with coronary sclerosis will increase the symptoms and may lead to congestive failure or coronary occlusion with infarction. Patients with coronary sclerosis will therefore tolerate pulmonary infections poorly due to the pulmonary hypertension associated with these infections. Likewise, pulmonary fibrosis, emphysema, spinal arthritis or marked chest deformity are particularly disabling in these patients.

The author recommends a low sodium diet, mercurial diuretics, oxygen along with chemotherapy and antibiotics to combat the infections. He suggests that if surgical treatment of tuberculosis is necessary, resection of the diseased portion of the lung is preferable to thoracoplasty in patients with coronary sclerosis. The relation of anoxia to pulmonary hypertension is discussed.—*F. M. Windrow, M.D.*

Behrendt, H. Über den Bronchialdrüsendurchbruch. (Intrabronchial rupture of lymph nodes.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis.* Sept., 1951, *75*, 318–322.

This occurrence, in tuberculosis, is more common, and usually less serious than heretofore considered. The consequences depend upon the infectiousness and consistency of the caseous material and the resistance of the patient. A fairly solid mass may even cause death by obstructing the glottis. The usual patchy pattern of bronchogenic spread may be masked by perifocal inflammation or atelectasis, and become evident only during the involution of these processes or by calcification.

The diagnosis may be made: (1) bronchoscopically; (2) by the course of the disease, some authorities considering all cases of bronchial spread to be due to this process; (3) by the clinical findings—bronchostenotic (bitonal) cough, simple bronchial compression without bronchial disease being rare in this series; or expectoration of calcific debris; (4) roentgenographically.

Rarely a cavity may be seen in a large hilar node, but usually if a fistula develops between a node and a bronchus, the node leaks slowly and never contains air. If a sudden complete emptying occurs, the walls usually collapse quite rapidly, hence cavitation should be suspected if a large node decreases rapidly in size. Schwartz has described cavities in large peripheral nodes which could not be distinguished from ordinary pulmonary cavitation by roentgenography. Laminagraphy showing a large node compressing a bronchus with an irregular wall is diagnostic. Bronchography, in the author's experience, has not been too useful, and has never succeeded in filling a cavernous node.—*J. J. B. Light, M.D.*

McCort, James J., and Robbins, Laurence L. Roentgen diagnosis of intrathoracic lymph-node metastases in carcinoma of the lung. *Radiology*, Sept., 1951, *57*, 339–360.

When cancer develops in the lung, roentgenography is the only available method for preoperative demonstration of intrathoracic regional lymph node involvement. It is frequently difficult to determine whether lymph node enlargement is caused by metastatic invasion or accompanying infection. Enlarged lymph nodes associated with laryngeal or phrenic nerve paralysis almost always contain metastatic cancer.

In a review of 103 selected patients with proved carcinoma of the lung treated surgically, the authors observed (1) the relative frequency of involvement of a given chain of lymph nodes in relation to the anatomic location of the primary tumor, and (2) the fairly constant roentgenographic appearance of these lymph nodes when they are enlarged by tumor or associated infection.

A detailed description of the anatomy and physiology and drainage of the pulmonary lymphatic system is given, emphasizing that spread via the lymphatics is a most important mode of dissemination of carcinoma of the lung. Investigation has demonstrated that particulate matter is carried from the lung directly into the lymph fluid and does not always undergo phagocytosis. The greater portion of the lymph from both lungs passes through the right paratracheal channels. Valves in the lymphatic system normally allow the lymph to flow in one direction only, toward the hilus. As a lymph node becomes replaced by growing tumor, it can no longer function as a filtering organ, and the valves are unable to overcome the force of flow into other lymph channels.

In discussing the roentgen technique, the authors recommend fluoroscopy of the chest with a swallow of barium to study the dynamics of respiration and observe indentation upon the esophagus. A minimum of three roentgenograms are taken—a posteroanterior, a lateral, and an overexposed grid or Bucky posteroanterior. Laminagraphy and angiocardiography add little information.

The authors present a detailed description, well illustrated with roentgenograms, of pulmonary malignancies with characteristic lymph node metastases as found in various segments of the lung. The different groups of lymph nodes are discussed separately and in detail.

It was not possible to determine a relationship between the segment of the lung involved by the primary tumor and the group of lymph nodes invaded by the metastases. It was concluded, however, that when a given lobe of the lung harbors the primary tumor, certain lymph node groups are more frequently involved than others.—*E. E. Seedorf, M.D.*

Watson, William L., and Smith, Robert R. Terminal bronchiolar or "alveolar cell" cancer of the lung; report of thirty-three cases. *J.A.M.A.*, Sept. 1, 1951, *147*, 7–13.

Among 1,585 patients with malignant lung lesions seen since 1932 at Memorial Hospital, New York, the authors found 33 with terminal bronchiolar cancer of the alveolar cell type. Pain and cough were common symptoms while frank hemoptysis occurred in only 1 patient, although some bloody sputum was noted in a total of 9. A roentgenographic diagnosis of malignant lung tumor was made in 65 per cent. Films of 1 patient were interpreted as negative, yet thoracotomy revealed the presence of a lung lesion with extensive invasion of vital structures. In 21 cases the sputum examination showed neoplastic cells and 3 patients had positive bronchoscopic biopsies.

This disorder is similar to jaagsiekte of sheep, which has been occasionally encountered in humans. However, alveolar septa are preserved in the latter condition, even though jaagsiekte has been observed to produce metastases in lymph nodes and subcutaneous tissue. True pulmonary adenomatosis is regarded as extremely rare. Its main characteristics are tall columnar cells, few mitotic figures and no stromal invasion.

Two of the 33 patients have survived more than five years. Four are dead and 5 are living six to twenty-four months after treatment by surgery or a combination of surgery, radon and deep roentgen therapy.—*J. W. Turner, M.D.*

EHRENHAFT, J. L. Pulmonary resections for metastatic lesions. *Arch. Surg.*, Sept., 1951, *63*, 326–336.

The author reports 9 patients in whom pulmonary resections were carried out for metastatic malignant lesions. The indications for selection of patients in this series were: (1) the apparently complete removal of the primary neoplasm, (2) absence of demonstrable metastases to other organs of the body, and reasonable assurance that all metastases were located in one area. If the extirpation of a metastatic focus will bring about the relief of pain, and carry with it the rare possibility of apparent clinical cure, such a procedure may be highly desirable.

There was only 1 immediate postoperative death. Five patients were alive and well at the time of the report and 2 additional patients were alive with evidence of intrathoracic recurrence of the neoplasm but without evidence of local recurrence.

It is concluded that the indications for such an operative procedure are complex, but they will become clearer as more experience is gained with particular lesions and with the passage of time.—*A. E. Childe, M.D.*

BERGMANN, MARTIN, ACKERMAN, LAUREN V., and KEMLER, R. LEONARD. Carcinosarcoma of the lung; review of the literature and report of two cases treated by pneumonectomy. *Cancer*, Sept., 1951, *4*, 919–929.

Carcinosarcoma is a tumor consisting of both carcinomatous and sarcomatous elements. The true carcinosarcoma is an entity with the parenchyma of the tumor made up of carcinoma and the stroma of sarcoma. Collision carcinosarcoma is the result of chance intermingling of adjacent carcinoma and sarcoma; hence, the microscopic picture of a single area may resemble closely the true carcinosarcoma. Sections through many areas, plus reticulin stains to elucidate the nature of the sarcomatous element, should be made in establishing the diagnosis. The metastases of carcinosarcoma may show elements of either type or of both.

Among 258 surgically removed bronchopulmonary tumors at Barnes Hospital, St. Louis, two carcinosarcomas were found. Only 8 other such pulmonary tumors were described in the literature, although carcinosarcomas in other organs, particularly the uterus, have been observed frequently.

The 2 patients with carcinosarcoma seen by the authors presented a course and findings similar to those found in other pulmonary neoplasms. Both were in the sixth decade of life and had as main symptoms cough, fever, malaise and weight loss. Roentgenograms showed enlargement of the hilus with distal atelectasis, due to pedunculated intrabronchial papillary lesions with limited parenchymal invasion. The treatment consisted of pneumonectomy, 1 patient being alive and without recurrence six years and the other nineteen months after the operation.

Experimental evidence in animals is cited to prove that carcinosarcoma is a true entity.—*H. J. Klos, M.D.*

JAFFÉ, FREDERICK A. Graphite pneumoconiosis. *Am. J. Path.*, Sept.–Oct., 1951, *27*, 909–924.

The author states that relatively little attention has been paid to the effects of graphite dust on the lung, in spite of the fact that many workers in many industries are exposed to it.

Graphite is obtained in mines or open quarries. Some deposits are almost pure graphite, while others contain as much as 33 per cent impurities, particularly silica and iron.

There is a diversity of opinion as to whether the pulmonary changes are due to the graphite itself, or to the silica content in the inhaled dust. One author stated that "pure graphite will not produce fibrosis of the lung."

A single case of pneumoconiosis is presented in which the right upper lobe had been resected and examined grossly and microscopically. The specimen showed a granulomatous reaction due to inhalation of graphite, characterized by areas of fibrosis, necrosis, and cavitation, with obliterative changes in blood vessels and bronchi.

The total silica content of the lung tissue was within normal limits. The opinion is expressed that the lesions in the lungs may be attributable to the graphite itself and not to the admixed silica.—*A. W. Finestone, M.D.*

Garsche, R. Zur klinischen Bedeutung der Röntgendiagnostik bei der interstitiellen Pneumonie frühgeborener Kinder. (The clinical value of the roentgen diagnosis in interstitial pneumonia of premature infants.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Aug., 1951, *75*, 125–138.

The author presents several cases of a relatively little known clinical entity, first described in Germany by Nitscke in 1939 and called interstitial pneumonia of premature infants.

The condition occurs practically always in premature infants with a weight below 1,500 gm. at birth and appears in the third month of extrauterine life. The only symptom, in uncomplicated cases, is a sudden or gradual increase in frequency of respiration, reaching 120–140 per minute. The mode of respiration changes to a costal type and the tachypnea subsides in favorable cases after eight to twenty days. The temperature is normal, physical signs are absent, the patients continue to gain weight during the disease.

The roentgen appearance is often typical, showing at the beginning a haziness of both lung fields with basal emphysema. The author calls this the "stadium edematosum" and states that clinical symptoms are absent at this stage. An increase in the edema causes the appearance of scattered atelectasis, "the stadium atelectaticum," characterized by multiple irregular shadows resembling scattered bronchopneumonic foci with a generalized haziness and basal emphysema. In the third stage, "stadium ephysematosum," multiple emphysematous bullae develop in both lung fields, interspersed between the atelectatic foci. Emphysema often involves the mediastinum extending sometimes into the tissues of the neck.

The clinical course of the disease is variable, with a fatal termination in about 60 per cent of the cases. Secondary infections are often observed. The etiology is unknown. The incidence varies in different European countries and the disease is apparently unknown in the United States.

A special roentgenographic technique was developed by the author which avoids the dangers of infection and loss of heat. A closed little bed was constructed with a cassette holder at the bottom in which the baby is transported into the roentgenographic room and the exposure is made without removing the patient from this bed.—*K. E. Matzinger, M.D.*

Graham, Evarts A. Some questions about bronchiogenic carcinoma. *New England J. Med.*, Sept. 13, 1951, *245*, 389–396.

There has been a great increase in the incidence of carcinoma of the lung. In three institutions its incidence has been reported as greater than that of carcinoma of the stomach. There is a marked predilection for males, although no inherent sex difference between male and female lungs can be discovered.

Cigarette smoking is seen to be the factor accounting for both the increased incidence and sex difference. The relationship between the increase of cigarette sales and lung carcinoma runs parallel. In one series of 605 males, 51.2 per cent were "excessive" smokers and only 2 per cent were nonsmokers.

Women have been shown to be less heavy smokers and to have smoked for shorter times than comparable groups of males. It would seem that long duration of smoking is of equal importance. Ninety per cent of the patients with carcinoma of the lung had smoked for more than twenty years

Other exogenous factors have been incriminated in certain series, *i.e.*, the high incidence of carcinoma of the lung in the Schneeberg Mines.

Squamous cell carcinoma is the type practically always associated with excessive cigarette smoking while adenocarcinoma appears to be unrelated. There may be specific carcinogenic agents responsible for each of these two types.

Bronchial adenoma is potentially malignant and may give rise to adenocarcinoma.

Why carcinoma of the lung metastasizes so frequently to the adrenals is unknown.

Only 25 or 30 per cent of cases of bronchiogenic carcinoma reaching the surgeon are resectable. Frequently the cause lies in faulty diagnosis. Usually an antibiotic has been prescribed for a "virus pneumonia."

The question of lobectomy versus pneumonectomy will be decided in the future, it is hoped, by functional examination of the lungs and not by cruder clinical forms of evaluation.—*L. A. Davis, M.D.*

Murray, J. F., and Brandt, F. A. Histoplasmosis and malignant lymphoma. *Am. J. Path.*, Sept.–Oct., 1951, *27*, 783–800.

The first recorded case of histoplasmosis from Africa was that of Simson and Barnetson in 1942. At the time of publication, their patient appeared to be maintaining a fair state of health. Subsequently, however, his condition deteriorated and he died a few months later.

Despite the rarity of the condition, it has been approached from many clinical aspects. It has been a pediatric problem; a part of the differential diagnosis of pulmonary calcification, of otolaryngeal conditions, of oral lesions in dentistry, of genital lesions, and of dermatologic and mucosal ulcerative lesions; and a condition often regarded as associated with lymphoblastoma.

A review of the literature revealed a total of 131 cases with only 3 occurring in Africa.

The authors report 3 additional cases. The first 2 cases are straightforward examples of histoplasmosis, 1 of which was complicated by tuberculosis. The third case resembled a malignant reticulosis clinically and histologically.

Of the 134 known cases of histoplasmosis 16 had a histologic picture resembling malignant reticulosis. The authors believe that the association of histoplasmosis and malignant lymphoma may be explicable on the basis of a cytologic reaction of the reticulo-endothelial system to stimulus by a specific infection. Whether this means that the resultant reaction is a malignant lymphoma or merely a "lymphoma-like" picture is not clear at present.—*J. M. Kohl, M.D.*

Park, W. Wallace, and Lees, James C. The absolute curability of cancer of the breast. *Surg., Gynec. & Obst.*, Aug., 1951, *93*, 129–152.

In their summary and conclusions the authors make the following observations:

1. The treatment of cancer of the breast is based on the hypothesis that earliness of treatment increases the cure rate. It follows that the only direct evidence that such treatment is effective will be the finding that delay in treatment does indeed diminish the cure rate. Review of the literature showed that this direct evidence has not been found. This failure is due partly to the variability, and opportunity for biased observation, of estimates of the date of onset of symptoms. However, in the main it is due to the great variability in growth rates between different cancers of the breast.

2. The maximum apparent curability has been found in two ways:

a. It was found that, in cancers of the breast diagnosed by conventional standards, the proportion of cases with axillary metastases at operation increased from 60 per cent in patients operated on at the time of onset of symptoms to about 75 per cent in those in whom operation had been delayed till three years after onset of symptoms. If current beliefs in the eradicability of cancer are accepted rigidly and the assumption is made that the cancer has already spread outside the zone of possible excision in 80 per cent of the cases with axillary metastases and in 30 per cent of the cases without, it will follow that the five year survival rate of those operated on at the onset of symptoms is 40.0 per cent, and of those operated on after a delay of three years, 32.5 per cent.

The difference between these survival rates is the maximum apparent curability.

b. The literature shows that the difference between the five year survival rates of patients with mammary cancer who were treated and those who were not treated is about 20 per cent—also a maximum apparent curability.

3. It has been explained how variability in growth rate between different cancers combined with the use of a survival rate as a measure of cure can create an apparent cure rate which is partly or wholly fictitious. From an analysis of the evidence, it has been shown that the apparent curability of cancer of the breast can be explained entirely in terms of the variability of growth rate.

4. The results of this examination of true curability of cancer of the breast can therefore be summarized as follows:

(a) It has not been proved that the survival rate of cancer of the breast, using the five year survival rate as an index, is affected by treatment at all.

(b) The evidence strongly suggests that treatment is quite ineffectual in reducing the incidence of death from metastatic spread.

(c) If treatment is in any way effective, the effectiveness cannot be greater than that required to increase the over-all five year survival rate by more than 5 to 10 per cent.—*Mary Frances Vastine, M.D.*

Kozonis, M. C., Wiggers, R. F., and Golden H. M. Primary liposarcoma of the mediastinum. *Ann. Int. Med.*, Sept., 1951, *35*, 703–710.

Liposarcoma is a rare tumor and even rarer as a mediastinal tumor. In the majority of the 200 cases reported it has occurred superficially, or in different organs. Only 4 cases have been described with primary location in the mediastinum. Perkins and Bowers in 1939 reported a 9 cm. posterior mediastinal tumor, in an eighteen year old girl, removed surgically with no metastases. Narr and Wells reported a myxolipoma, in a thirty-three year old man, encapsulated and attached to the mediastinum and no metastases. Joske found a posterior mediastinal liposarcoma in an eighteen year old male; it had infiltrated intercostal muscles but responded to surgery and irradiation. Ackerman and Wheeler described the necropsy findings in a fifty year old female, whose left chest was filled with a lobulated, encapsulated soft tumor, showing microscopically invasion of the small blood vessels.

Caldwell and Zinninger distinguished three types of liposarcoma: (a) liposarcoma with myxomatous degeneration; (3) lipoma from fibrous tissue stroma with sarcomatous degeneration; and (c) liposarcoma from fatty tissue, encapsulated, extending locally and producing metastases. Geschickter has described the variable picture while Ackerman and del Regato point out that the tumor may be well differentiated or it may contain bizarre lipoblasts.

These tumors may occur at any age and are usually single. They may grow very slowly and remain asymptomatic for years and then suddenly increase in size and become clinically evident. They are usually encapsulated. Pain is seldom found. The period from symptoms to metastases is about ten years.

The case reported in extenso by the authors is that of a fifty-seven year old man with upper mediastinal liposarcoma that invaded the superior vena cava. This tumor at first responded to deep roentgen therapy, but later metastasized widely. Necropsy findings are detailed.—*G. H. Ramsey, M.D.*

Storey, Clifford F., and Knutson, Kenneth P. Liposarcoma of the mediastinum; report of a case with associated lipomas of the mediastinum and subcutaneous tissues. *J. Thoracic Surg.*, Sept., 1951, *22*, 300–315.

This is a report of a case of primary liposarcoma of the mediastinum associated with a mediastinal lipoma and a subcutaneous lipoma of the anterior abdominal wall. This appears to be the sixth case of solitary mediastinal liposarcoma recorded in the literature. There are only 3 reported instances of the concomitant occurrence of liposarcoma and lipoma, and there is no record of the simultaneous occurrence of mediastinal liposarcoma and lipoma. The mediastinal tumors were successfully resected, making this the third recorded mediastinal liposarcoma to be removed surgically.

The treatment of liposarcoma is discussed and reviewed. Although many of the tumors are radiosensitive, ultimate recurrence and metastasis have been the rule with radiation therapy. The authors believe surgical excision to be the treatment of choice.—*T. C. Stansbury, Jr., M.D.*

Towbin, Milton N. Mediastinal emphysema occurring with therapeutic pneumoperitoneum; report of ten cases. *Ann. Int. Med.*, Sept., 1951, *35*, 555–592.

The author presents an exhaustive review of the literature on mediastinal emphysema from all causes, going back to Laennec in 1819.

When the mediastinal emphysema originates below the diaphragm it is almost always due to a perforation of a hollow viscus. The perforation is usually retroperitoneal and the gas travels upward in the perivascular tissues through the aortic hiatus.

Only 15 cases of mediastinal emphysema following pneumoperitoneum had been reported prior to the 10 presented in this paper. The route by which the gas reaches the mediastinum is still debatable. The author discusses several theories as to the path taken by the escaped gas in interstitial pulmonary emphysema, in reaching the mediastinum, along with similar theories as to the route taken by gas escaping from various abdominal viscera to the mediastinum.

In all of the cases presented, the emphysema subsided rapidly and did not recur following subsequent injections of air into the peritoneum. The clinical findings were crepitation in the mediastinal area synchronous with the heart beats, subcutaneous emphysema, decreased area of cardiac dullness and distant heart sounds. The patients complained of precordial pain, dysarthria, dysphagia and subcutaneous emphysema.

The treatment is usually symptomatic unless intramediastinal pressure becomes excessive, when cutaneous incisions may be made in the suprasternal notch to facilitate rapid release of the entrapped air. —*F. M. Windrow, M.D.*

Wassersug, Joseph D. Common pitfalls in the x-ray diagnosis of tuberculosis. *New England J. Med.*, Oct. 18, 1951, *245*, 598–600.

The increased emphasis on the roentgen film diagnosis of tuberculosis has not been accompanied by warnings of possible diagnostic errors. The author believes that roentgen examination alone is rarely enough, and he cites many cases in which a little clinical knowledge would have been helpful in avoiding serious diagnostic errors. Many of the pitfalls illustrated are technical in nature. Others are medical and are actually wrong diagnoses based on interpretation of roentgenograms alone without clinical evaluation or correlation.

The conclusion is drawn that clinical appraisal and bacteriologic investigation are at least as important as roentgen examination in the diagnosis of pulmonary tuberculosis, and that the final diagnosis should be made only after correlation of all three.—*R. E. Kinzer, M.D.*

Tapia, M. Sobre un síndrome de estenosis bronquiolar idiopática progresiva subaguda de causa desconocida y evolución mortal (¿nuevo síndrome respiratorio?). (On a syndrome of progressive subacute idiopathic bronchiolar stenosis of unknown cause and fatal evolution; new respiratory syndrome?) *Bol. Inst. Pat. Méd.*, March, 1951, *6*, 41–50.

Two patients were observed who suffered from a respiratory syndrome with the following fundamental characteristics:

(a) The appearance, in a person without respiratory antecedents, of a picture of permanent and progressive dyspnea, enhanced by effort and finally persisting even at rest.

(b) Cough, at times paroxysmal and almost whooping, but with scant or no expectoration.

(c) Locally, normal or diminished percussion note, with diminution of respiratory murmur, but without signs of inflammation or consolidation.

(d) Roentgenologically, a picture of diffuse bronchiolar stenosis with formation of multiple emphysematous bullae.

(e) Absence of acute infectious signs during the evolution of the disease, but at times the appearance of infection by retention.

(f) Fatal evolution, in a few months, due to respiratory insufficiency.

One male patient, aged sixty-three, presented the clinical and roentgenologic picture described in the right lung only and died in eighteen months. Another male, aged forty-eight, presented a similar picture involving the right upper lung field and hilar area as well as most of the left lung, and died in ten months. Differential diagnosis excludes tuberculosis, syphilis, lipoid and various types of interstitial pneumonia.—*C. M. Nice, M.D.*

BINDI, V., and LENZINI, L. I processi epitubercolari nell' infanzia con particolare rigardo alla loro patogenesi. (The epitubercular processes in infancy, with particular regard of their pathogenesis.) *Riv. clin. pediat.*, Aug., 1951, *49*, 567–584; and Sept., 1951, *49*, 631–653.

Epituberculosis is a term commonly employed by European authors to indicate the first infection of pulmonary tuberculosis. In this form of tuberculosis the tubercle bacilli cannot be found and there occurs a tissue reaction which may be of an allergic nature. The authors have studied 30 cases of epituberculosis occurring in children whose age varied from one to thirteen years.

The usual clinical symptoms of the chronic cases were only low grade temperature and a poor state of nutrition. Only the rare acute cases may show persistent cough, dyspnea, bronchial asthma and marked elevation of temperature. In the chronic cases, the average duration of the disease was about one year.

Roentgenologically, the authors observed marked hilar adenopathy, often accompanied by a diffuse opacity extending from the hilar regions outward and involving the lung in a segmental or lobar fashion. The authors believe that these opacities are due to peripheral atelectasis resulting from the mechanical compression of the bronchi by the large hilar lymph nodes. This view seems confirmed by the finding of stenotic bronchi in overexposure and laminagraphic studies.—*Cesare Gianturco, M.D.*

BERNSTEIN, ARTHUR, and PERLMAN, LAWRENCE. *Salmonella senftenberg* pneumonia; report of a case. *Ann. Int. Med.*, Sept., 1951, *35*, 721–728.

The authors believe their case to be the first reported pneumonia due to *S. senftenberg*. Since the description of *S. senftenberg* in 1928, by Kauffmann, the organism has been isolated in many outbreaks and has been shown to have the ability to produce a wide variety of clinical manifestations.

Seligman and his co-workers reported 2,000 human Salmonella infections with 2 of the senftenberg type. In an earlier series of 1,000 cases recorded there were 9 senftenberg infections. Rubenstein *et al.* in 771 cases observed 7 and Edwards *et al.* found 12 in 1,677 outbreaks in man.

Clinically, there are three types of salmonellosis: (1) the gastroenteric type due to *S. typhi murium;* (2) the salmonella fever or typhoid and parathyphoid fever; and (3) the septicemic type, with protean manifestations and high mortality due to *S. cholerae suis*.

Pulmonary lesions due to Salmonella have been described by various authors, mainly due to *S. cholerae suis*.

The first fatal case of human intestinal infection caused by *S. senftenberg*, reported by Curphey, showed no lung involvement.

The case reported by the authors is that of a forty-two year old colored female, with penumonia, in which the etiologic agent was *S. senftenberg*. There was a previously damaged kidney which gave rise to nitrogen retention and a hepatitis by clinical and laboratory findings. A good therapeutic response was obtained with general supportive measures despite marked resistance of the organism to penicillin and streptomycin.

Three roentgenograms of the chest are shown and extensive laboratory findings are recorded.—*G. H. Ramsey, M.D.*

CONNAR, RICHARD G., FERGUSON, THOMAS B., SEALY, WILL C., CONANT, NORMAN F. Nocardiosis; report of a single case with recovery. *J. Thoracic Surg.*, Oct., 1951, *22*, 424–433.

A case is reported of a thirty-seven year old white man who was explored for a possible pulmonary neoplasm and subsequently found to have nocardiosis. The patient survived following drainage of an empyema cavity and intensive sulfonamide therapy, and is living and well one year later.

Nocardiosis is caused by *Nocardia asteroides*, an aerobic, gram-positive, partially acid-fast Actinomyces. The mycology of this case is discussed. Pathologically, both an acute and chronic inflammatory reaction which differs from tuberculosis by the absence of epithelioid tubercles and caseation is present.

Forty-three cases of nocardiosis have been reported in the literature (including this case). Only 8 cases can be considered clear cut examples of recovery. Those recovering all received sulfonamide therapy in one form or another. It is essential that these patients receive adequate dosage of sulfonamides and they apparently should remain on therapy for four to six months.

The paucity of cases reported may well be due to failure of recognition. Nocardiosis should be considered in all patients with obscure or unusual chronic pulmonary infection, especially when repeated attempts to demonstrate the tubercle bacillus have failed.—*T. C. Stansbury, Jr., M.D.*

MILLER, ISIDORE ROD, and GROSSMAN, SOLOMON. Benign histoplasmosis in siblings. *J.A.M.A.*, Oct. 20, 1951, *147*, 753–755.

The chest roentgenograms of 2 Negro brothers six years and three years of age are presented. They showed calcified nodules in the older boy and a "mediastinal density" in the younger. Tuberculin tests were negative up to 1:100 dilution; the histoplasmin skin sensitivity test was positive in a dilution of 1:1,000 in both children. In one the complement-fixation test was positive in undiluted serum; in the other, it was negative. The diagnosis of a benign

form of histoplasmosis was therefore made.—*J. J. McCort, M.D.*

Robertson, Philip W., and Morle, K. D. Forgan. An explanation of the "primary atypical pneumonia" syndrome. *Brit. M. J.*, Oct. 27, 1951, *1*, 994–998.

The authors present convincing arguments for their concept that "primary atypical pneumonia" is an aspiration type of pneumonia secondary to aspiration of products from an associated upper respiratory infection. Comparison of the features of the atypical pneumonia as reported by various investigators with the 500 cases from the authors' series reveals that the disease conditions are essentially similar. The salient clinical features include cough, initial scanty sputum, later copious sputum, occasionally blood streaked sputum, chest pain and dyspnea. The low white blood cell count, the lack of response to chemotherapy, and the roentgen appearance of the lesions also correspond to those described in the literature under the term of primary atypical pneumonia.

In the roentgen examination of these patients, lateral views are considered essential. The disease shows localization to the bronchopulmonary segments. There is great variation in the lung field density as reported from "ground-glass" opacity to increased bronchovascular markings. The lesions are confined to the basilar segments, for the most part, and some degree of partial collapse is present in many instances. The enlargement of the hilar lymph nodes and pleural effusion are seldom seen. Abscesses are rare but occurred in 2 cases of this series.

The points against a pneumotropic virus etiology for this pneumonic syndrome are: (1) the cases follow some upper respiratory infection; (2) the dependent bronchopulmonary segments are involved; (3) characteristic outbreaks at military training camps are dissimilar to other known infections in that the disease attacks the new recruits while the administrative staff is rarely affected; (4) recurrences in the same or other bronchopulmonary segments are often seen which is most uncommon with virus diseases; and (5) the aspiration mechanism offers an explanation for the extreme variation in the clinical course as the material aspirated may be mucus or grossly infected pus.

Assuming aspiration as the basis for these lesions, the approach to treatment is greatly simplified. The use of percussion postural drainage for reaeration and drainage of the infected segments is effective. There should be no indiscriminate use of antibiotics.

The routine use of lateral roentgen examination gives an estimate of bronchial abnormality. As serious irreversible bronchial changes may occur, the supervision of the original illness depends on these findings. This is a contraindication of the views that primary atypical pneumonia is essentially a benign condition which clears without serious sequelae.—*T. D. Allison, M.D.*

Overholt, Richard H., and Woods, Francis M. Early diagnosis and treatment of cancer of the lung. *New England J. Med.*, Oct. 11, 1951, *245*, 555–559.

Primary lung cancer may exist in a silent or asymptomatic state for months and occasionally years. Several reports in the literature record an incidence of 40 to 60 per cent malignancy in silent tumor suspects who were explored.

Mass chest photofluorographic surveys are designed chiefly to detect early tuberculosis, but discovery of lung cancer is a by-product. In a recent Boston survey, 536,012 films were taken and 398 suspected tumor cases reported; 76 were ultimately diagnosed as primary lung cancer. The American Cancer Society undertook the follow-up of the suspected tumor cases; the average cost of each case subsequently identified as cancer was a mere $80.

Definite diagnosis of cancer by bronchoscopy or cytologic study of the sputum was not possible in 75 per cent of the asymptomatic cases. Of such patients, 10 were promptly explored. All were resectable and only 30 per cent showed evidence of lymphatic extension. In 19 cases exploration was delayed for further diagnostic efforts, and 53 per cent had lymphatic extension, although all were resectable. These figures are in sharp contrast to a large series of symptomatic cases, where only 30 per cent were resectable and 89 per cent showed lymphatic extension.

Therefore, thoracic exploration is imperative in the asymptomatic patient with suspected but unproved lung cancer. The issue at stake is so vital that time must not be wasted in prolonged and repeated attempts to establish the diagnosis.—*A. A. Brewer, M.D.*

Charpin, J., Métras, H., and Gaillard, C. Bronchographie dirigée à la diiodone. (Directed bronchography with diiodone.) *Presse méd.*, Oct. 24, 1951, *59*, 1391–1393.

In most cases bronchography ought to be complete. Incomplete visualization which does not clarify an aerated segment within a density is useless and dangerous. Segmental bronchography made with a catheter should be employed under these conditions. This is particularly true in bronchiectasis. A second indication for segmental bronchography is found in the study of lung abcess which may be injected through a catheter. Valuable information may be obtained both at the beginning and in the terminal stage of treatment.

Water soluble substances which are now available for bronchography have eliminated many of the ob-

jections to the use of lipiodol. The material is rapidly dissipated. Several instillations can be made with varying positions of the catheter. The distal bronchi are very tolerant of these substances and cough is avoided. If necessary, reflux into proximal bronchi, which may produce cough, is avoided by permitting the catheter to block the injected area.—*M. L. Sussman, M.D.*

FROMMHOLD, W. Die Bronchographie in Intubationsnarkose. (Bronchography with intubation anesthesia.) *Fortschr. a.d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1951, *75*, 419–430.

Any type of bronchography is still a procedure which may not be without dangerous consequences to the patient. All other clinical and roentgenological diagnostic means should be employed before bronchography is resorted to. Laminagrams may demonstrate bronchial obstruction and should be done in every case before bronchography.

The use of a small intrabronchial catheter makes it possible to select a suspected segment of the lung for careful individual study. The question of an efficient, but entirely harmless local anesthetic has not been settled. Pantocaine seems most advisable, but is not without danger.

Intratracheal general anesthesia has been tried by the author. After insertion of the tracheal tube, curarine is administered intravenously causing a motor paralysis and necessitating artificial respiration by means of a breathing bag. Under fluoroscopic control, a bronchial catheter is introduced into the segmental bronchus in question. After injection of the contrast medium, the artificial breathing is stopped for a few seconds allowing for a roentgenogram to be taken without any distortion by movement. This method is, in the opinion of the author, considerably less dangerous than the one using local anesthesia. It permits bronchography in patients who are not able to cooperate because of physical or psychic limitations. A considerable technical apparatus using numerous assistants is, however, essential for this type of procedure.

The use of iodized oil is not recommended for opacification since any oil is apt to produce aspiration pneumonitis. There is no indication that water soluble, iodine containing, media cause a pneumonitis similar to that seen after iodized oil. Ioduran B and iodosorb, both water soluble, give bronchograms of good quality, in no way inferior to those done with iodized oil. No trace of the contrast material could be demonstrated twenty-four hours after the procedure.—*H. W. Hefke, M.D.*

ANDERSEN, PREBEN THESTRUP; ANDERSEN, IB; ELTORM, HELGE; POULSEN, THUE; GLISTRUP, E.; and PETERSEN, HILDA. Angiopulmography. *Acta radiol.*, Oct., 1951, *36*, 257–269.

The writers use a simple method for doing angiopulmography whereby the cassette changer consists of a slide box which closes automatically when the cassette is in place. Changing is manual, the new cassette releasing the stop and pushing the exposed cassette out. The film size used is usually 35 by 35 cm. The patient is supine in position with his chest immediately above the cassette changer. Eight to ten exposures in the course of ten to fifteen seconds are made. All roentgenograms are taken in the anteroposterior view since the apparatus is not adapted to the taking of two views at the same time.

Seventy per cent diiodone is used, the usual dose for adults being 100 cc. Percutaneous injection lasting two to ten seconds is done in the antecubital vein with a large record syringe and a large bore needle.

General anesthesia with sodium pentothal and with the simultaneous administration of oxygen is employed.

The authors review the literature and report 11 cases of their own. In the discussion they note that central tumors of the upper lobes result in displacement, compression or occlusion of the pulmonary artery and, in case of increased expansion, in changes of the superior vena cava in the form of compression or invasion of the vessel. Complete or partial occlusion of the pulmonary vessels manifests itself in the form of reduced filling on the affected side, whereas the vessels on the unaffected side show accumulation of the opaque medium. In 2 instances, angiopulmography was the only diagnostic procedure which demonstrated inoperability showing a characteristic tumor stop and invasion of the superior vena cava.

In cases of peripheral tumors it is considerably more difficult to interpret the angiopulmographic appearances. In 1 instance, however, peripheral vascular changes with reduced blood flow through the tumor and increased vascularization in its peripheral areas was observed.

The writers feel that the differentiation between benign and malignant peripheral infiltration on the basis of the vascularization is an extremely problematic matter. However, no vascularization is seen in the infiltrations representing cysts or tuberculomas.

Angiopulmography has failed to afford any diagnostic aid in tuberculosis and bronchial asthma. In the authors' only case of angiocardiography, the diagnosis of valvular pulmonary stenosis was confirmed.—*Mary Frances Vastine, M.D.*

THURN, P. Röntgenkymographische Differentialdiagnose der Lungenstauung und Lungenhyperämie. (Differential diagnosis of pulmonary congestion and pulmonary hy-

peremia by roentgen kymography.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1951, *75*, 406–415.

Pulmonary hyperemia is seen with various congenital heart lesions where it is accompanied by pulmonary hypertension and increased blood flow through the pulmonary arteries. Pulmonary hypertension is also present in emphysema, kyphoscoliosis, extensive pleural thickening, silicosis and primary pulmonary artery sclerosis, but increased blood flow is not always present. By definition, pulmonary hyperemia must be accompanied by increased pulmonary blood flow and pulmonary hypertension. Pulmonary congestion affects the veins only and is best seen in mitral stenosis and myocardial failure.

Roentgen kymographically, no active pulsations are seen in the hilar vascular structures in pulmonary congestion. Transmitted pulsations are stopped or decreased by the weight of the blood in the congested veins and by the alveolar transudate and edema in the lung roots. The movement of the pulmonary veins is entirely of a passive nature.

In pulmonary hyperemia, active pulsations of the arteries can be demonstrated in the hilar areas, best seen in the artery to the right lower lobe. Changes in density of the hilar arteries due to systole and diastole are also described.—*F. M. Reis, M.D.*

Birath, G., and Crafoord, C. Function tests in pulmonary surgery. *J. Thoracic Surg.*, Oct., 1951, *22*, 414–423.

To obtain widened indications for pulmonary surgery in patients who, because of impaired function, would otherwise be deemed unfit for operation, pulmonary function should be evaluated by analysis.

The authors differentiate between: (1) *ventilation insufficiency*, which arises from bronchial anomalies or reduced costal and diaphragmatic mobility; (2) *parenchymatous insufficiency*, quantitative (loss of parenchyma), or qualitative (impaired diffusion of gases); (3) *insufficiency of the pulmonary circulation* blockage or shunt).

The routine methods employed by the authors are: (a) *Roentgenological examination*, with registration of the movements of the diaphragm and thoracic cage. (b) *Spirometric investigation*, which includes the total lung volume and its subdivisions and the maximal ventilation capacity. Special importance is attached to the relationship between the residual and total capacities and between the equilibrium and total capacities. Disparity in these relationships often heightens with increasing dyspnea. (c) *Bronchospirometry*, which is performed when other investigations show significant impairment of *total* lung function. (d) In certain cases, *catheterization of the pulmonary artery*, to determine the pressure at rest and during exercise.—*T. C. Stansbury, Jr., M.D.*

Sones, F. Mason, Jr., and Effler, Donald B. Diagnosis and treatment of aortic rings. *Cleveland Clin. Quart.*, Oct., 1951, *18*, 310–320.

This article is a successful attempt to simplify an important diagnostic problem. The authors have used the classification of Edwards as the logical and complete classification of anomalies of the great blood vessels of the aortic arch. From this classification, they have derived a simpler clinical classification to be used in the practical attempt to recognize the anomaly at hand. Their classification consists of two groups—those with left descending aorta, and those with right descending aorta. In each group, there are two other clinically recognizable variants, namely, right and left subclavian artery variants and functioning double aortic arches. In order to utilize this classification clinically, the physician must only be able to identify the position of the upper portion of the descending aorta.

Examination of the esophagus is the simplest method of determining the presence of an anomaly of the aortic arch. In adults this is usually easy, but in infants it may be very difficult to arrive at any accurate estimation of the type of anomaly. However, the presence of a pressure deformity on the posterior aspect of the esophagus at the level of the arch is presumptive evidence and retrograde aortography may be necessary to further clarify the exact type of anomaly.

Surgical approach and medical management are briefly discussed. This article and that of Edwards should be required reading for pediatricians and roentgenologists.—*R. E. Kinzer, M.D.*

Schorr, S., Braun, K., and Wildman, J. Congenital aneurysmal dilatation of the ascending aorta associated with arachnodactyly; an angiocardiographic study. *Am. Heart J.*, Oct., 1951, *42*, 610–616.

Aneurysmal dilatation of the ascending portion of the aorta has been described as a congenital anomaly associated with the clinical syndrome of arachnodactyly (Baer, R. W., Taussig, H. B., and Oppenheimer, E. H. Congenital aneurysmal dilatation of the aorta associated with arachnodactyly. *Bull. Johns Hopkins Hosp.*, 1943, *72*, 309), in which the aorta showed histopathologically degeneration of the media.

Recently the authors studied a twenty-seven year old female who exhibited long slender hyperextensible fingers and cafe-au-lait coloration of the skin of the face, but no other stigmata of arachnodactyly. Fluoroscopic and film studies of the chest showed dilatation of the ascending aorta. Angiocardiography confirmed the fluoroscopic impression and showed in addition a filling defect on the lateral wall of the aorta in the upper descending portion, thought to be

a thrombus. The patient is still living and in good health.—*Harold Fulton, M.D.*

TORELLI, GASTONE. Studio stratigraficodelle iperchiarezze para-aortiche. (Stratigraphic studies of the para-aortic hypertranslucencies.) *Ann. radiol. diag.*, 1951, *23*, 274–279.

Dahn, in 1942, described a translucent zone detected in the para-aortic area seen in a case of carcinoma of the left upper lobe of the lung. By horizontal sections of the frozen cadaver, he found that with atelectasis of the left upper lobe, the lower lobe expanded in size so as to occupy the para-aortic space normally occupied by a segment of the upper lobe.

With the aid of laminagraphy the author has found that diseases other than cancer of the lung may produce this para-aortic translucency which usually is seen lateral and somewhat posterior to the arch and descending portion of the aorta. He has found that the translucent zone may assume one of the following three shapes: In type A, due to atelectasis, as described by Dahn, it has the shape of a question mark. In type B, it is much thinner but has the same configuration as in type A and is best seen behind the heart shadow. It is due to normal tissue located behind the aorta with diseased lung tissue in its vicinity. In type C, the zone of translucency has a triangular shape and is best seen at the level of the aortic arch. It is due to normal lung tissue located posterior to the arch.

The author has observed in all his cases that the left upper lobe is decreased in size whether due to atelectasis or fibrosis with fixation of the mediastinum and displacement of the superior medial fissure which is rotated tangential to the axis of the roentgen beam. The protrusion of the expanded lower lobe between the vertebral column and the retracted upper lobe gives rise to the type C or triangular shaped zone of translucency seen in the para-aortic area.

This condition would have to be differentiated from herniation of the lung from the opposite side of the thorax. In these cases the zone of translucency is located posterior to the level of the arch and thoracic aorta.

Although these para-aortic zones of translucency can be seen on routine films of the chest they are never as clearly outlined as on laminagrams.—*P. E. Russo, M.D.*

ABRAMS, HERBERT L., KAPLAN, HENRY S., and PURDY, ANN. Diagnosis of complete transposition of the great vessels. *Radiology*, Oct., 1951, *57*, 500–513.

In complete transposition of the great vessels, the aorta arises from the right ventricle and the pulmonary artery from the left ventricle producing two closed circulations. Life is permitted only because of coexisting anomalies such as interauricular and interventricular septal defects, a patent foramen ovale or a patent ductus arteriosus.

Transposition of the great vessels is of slightly lower incidence than tetralogy of Fallot. It has been found more commonly in males. The majority of patients die within the first year, although a few have lived to adulthood.

The clinical findings consist mainly of cyanosis, dyspnea, clubbing and heart murmurs.

The hemoglobin and red blood cell count tend to be elevated, reflecting the degree of arterial oxygen unsaturation. Abnormalities of the electrocardiogram are described, with right axis deviation being a common finding.

The chest roentgenogram always shows cardiac enlargement which often progresses rapidly in the first month. Peripheral vessels are usually engorged. The superior mediastinum is frequently narrow and the aortic knob is usually not seen. Oblique views show widening of the great vessels.

Angiocardiography usually demonstrates the anterior position of the aorta arising from an enlarged right ventricle. Cardiac catheterization is helpful in determining the presence of a large interauricular septal defect.

The roentgen appearance of transposition of the great vessels in a patient with cyanosis from birth is often characteristic enough to establish the correct diagnosis when integrated with the clinical findings.

The differential features from tricuspid atresia, tetralogy of Fallot, truncus arteriosus, Eisenmenger complex and Taussig-Bing syndrome are described.

Four case histories are appended and seven figures included.—*E. E. Seedorf, M.D.*

NICHOL, A. D., and SEGAL, A. J. Complete transposition of the main arterial stems; report of a case. *J.A.M.A.*, Oct. 13, 1951, *147*, 645–648.

The history and pathological findings of a patient are presented showing complete transposition of the main arterial stems, hypertrophy of the right auricle and ventricle, atrial and ventricular septal defects, patent ductus arteriosus and coarctation of the aorta. The average duration of life in 117 cases having similar defects was five and one-half months. This patient lived twenty-nine years and was in congestive failure during the last three years; however, she was limited in exercise tolerance all her life. She was extremely cyanotic involving more the upper extremities. Roentgenography with contrast medium demonstrated the intracardiac shunt. The patient refused cardiac catheterization. The correct diagnosis was made at postmortem examination.—*F. H. Squire M.D.*

Campbell, Maurice. Morbus coeruleus; and its surgical treatment. *Lancet*, Oct. 13, 1951, *2*, 647–653.

The author discusses the early work of Taussig, Blalock, and Brock in the surgical treatment of tetralogy of Fallot and pulmonary stenosis.

It is pointed out that patients with right to left shunt have, what the author calls, a "central type" of cyanosis. Such a shunt cannot merely take place because there is an opening between the two sides, since this in itself, owing to the higher pressure on the left side, leads to the left to right shunt with an increase in the blood flow to the lungs. There must be a second abnormality that can raise the pressure in the right side. Pulmonary stenosis is the commonest cause of this rise of pressure with a high ventricular septal defect and overriding aorta as in Fallot's tetralogy, or with a closed ventricular septum but with a defect in the atrial septum (most often a patent foramen ovale). Here, the stenosis is nearly always at the pulmonary valves, whereas in tetralogy of Fallot it may be valvular, but is more often infundibular.

"Central type" of cyanosis is best seen in the conjunctiva, in the tongue, inside the lips, and in the nails when the hand is warm. It is most important to distinguish this type of cyanosis from peripheral cyanosis, which may occur in all sorts of conditions, such as mitral stenosis, chronic pulmonary disease, or after a bath on a cold day.

For a better understanding of blood flow to the lungs in congenital heart disease, the author proposes a classification based on the amount of blood flowing to the lungs. He suggests the terms "oligonoemic," diminished blood flow to lungs, and "pleonoemic," increased blood flow to the lungs. These again he subdivides into the cyanotic and acyanotic groups. "Pleonoemic" further denotes a left to right arteriovenous shunt that is of significant size. The appearance of the lung on the roentgenograms will be somewhat similar, whether the opening is between the aorta and pulmonary artery, between the ventricles, or between the atria; but the size of the heart and other features will help in distinguishing the groups.

In most instances, one can distinguish whether the lungs are "pleonoemic" or "oligonoemic." However, occasionally with atresia or severe degree of stenosis, the patient may have extensive collateral lung circulation and this may produce widespread lung shadows that may mask the diminished lung flow. Such shadows are finer than those of "pleonoemic" lungs, and the pulmonary arteries themselves are small. When there is doubt pulmonary artery catheterization should decide.

The author's criteria of operability are those enumerated by Taussig:

1. The disability must be due to inadequate blood supply to the lungs.
2. The pressure in the pulmonary artery must be less than 30 mm. Hg.
3. There must be adequate pulmonary and systemic arteries for anastomosis.

Included is a careful discussion of measurement of circulation times, cardiac catheterization, and angiocardiography.

Surgical results of his personally operated patients consist of 195 cases, with very good results in 61 per cent, fair in 14 per cent, and results nil in 9 per cent. His over-all mortality rate is 16 per cent. One hundred twenty-five patients were subjected to subclavian-pulmonary artery anastomosis. Valvulotomy and infundibular resection were performed in 70 patients. The mortality rate in the latter group was 23 per cent as compared with 12 per cent in the systemic-pulmonary anastomosis group.

This is a long treatise on the subject. The article contains much information with many reproductions of roentgenograms. The paper should be read in its entirety by those interested in the roentgen diagnosis of congenital heart disease.—*E. A. Addington, M.D.*

Morris, R. W., and Jacobs, L. M. Heart shape and body build. *Lancet*, Oct. 13, 1951, *2*, 666–668.

The authors state that there may be some truth in the old saying that a man's heart is as large as his clenched fist.

It is pointed out that a good deal of work has been done on the relations between external shape and the configuration of the viscera, but most of the investigators have used classifications of physique which are no longer considered adequate. The division of man into pyknic, athletic, and asthenic types must now be discarded, and some sliding scale such as that of Sheldon, *et al.*, should be adopted.

Material used was 109 male students, aged between eighteen and twenty-eight years. Each was somatotyped by photographic anthroposcopy, using a technique similar to Bullen and Hardy's modification of Sheldon's method. Standardized roentgenological methods were used.

With this procedure it was found that in 92 per cent of the cases the shape of the heart could be correlated with the somatotype of chest, abdomen, or body as a whole. In 8 cases the heart appeared to be in the wrong body. They suggest that the cause of this may be dysplasia, which indicated lack of harmony between the somatotypes of the five regions of the body.—*E. A. Addington, M.D.*

Davies, Robert R., Marvel, Robert J., and Genovese, P. D. Heart disease of unknown etiology. *Am. Heart J.*, Oct., 1951, *42*, 546–565.

In a five year period the authors studied 9 cases of heart disease in which no definite etiology could be found. All of the patients had symptoms of congestive heart failure with a one to five year duration of complaints. Their ages ranged from twenty-two

to forty-four years. An effort was made clinically to rule out the usual etiologic agents in cardiac disease by clinical examination, laboratory work, and roentgenologic study.

No characteristic roentgen signs were found. Chest films showed cardiac enlargement in all cases.

On necropsy there was cardiac hypertrophy with no valvular or coronary artery disease. The histopathologic sections of the myocardium showed hypertrophy with varying degrees of necrosis, fibrosis, and cellular infiltration. These 9 cases were classified as myocarditis of unknown etiology, and represent another cause of cardiac enlargement which must be considered from a clinical and roentgenologic viewpoint in differential diagnosis.—*Harold Fulton, M.D.*

SELZER, ARTHUR, HARRISON, MARLOW B., and DANILOFF, GLADYS TAYLOR. The detection of unsuspected heart disease in photofluorographic chest surveys. *Am. Heart J.*, Sept., 1951, *42*, 355–361.

In an attempt to evaluate the photofluorographic tuberculosis mass survey as a means of detecting unsuspected cardiac disease, a study was conducted for a period of thirty-one months by the Heart Division of the San Francisco Tuberculosis Association. During this period approximately 155,000 thirty-five millimeter photofluorograms were taken. If any of the film interpreters suspected heart disease the report was marked "cardiac" and the subject was asked by letter to return for fluoroscopic examination. Of the 1,356 such patients invited to return, 846 did so, and in 174 cases the fluoroscopist found nothing to suggest cardiac disease, in 158 cases the findings were questionable, and in 514 cases disease of the heart or aorta was still suspected. Of the 193 patients of the last group who came to clinical study, 85.5 per cent were finally considered to have cardiac disease. The result of the entire study was that only 89 cases of previously unsuspected heart disease were discovered by this survey (about one-half of the patients in the last group being known "cardiacs"), a total of 0.059 per cent of the 155,000 of the patients examined.

In a study of this type fluoroscopic re-examination of patients with photofluorographic films marked "cardiac" seems essential, as in this series only 60.7 per cent of the suspects selected by the film readers were still considered as definitely abnormal after fluoroscopy. It is probable then that fluoroscopy could thus at least partially eliminate the false-positive cases in which the heart appears unduly large on the minifilm due to technical factors. Other false-positives are the result of the disagreement between two film interpreters or between two or more readings by the same individual.

The 89 cases of previously unknown heart disease discovered represents a disappointingly small yield for a survey of such magnitude and thus it is concluded that "the procedure for detecting unknown heart disease as a by-product of a tuberculosis survey is not of sufficient value to warrant its routine use."—*Harold Fulton, M.D.*

GENOVESE, P. D., and LEVIN, R. T. A study of the value of roentgenologic demonstration of valvular calcifications. *Am. Heart J.*, Sept., 1951, *42*, 344–354.

In a period of about three years the authors studied 74 male patients, with an average age of 50.2 years, who were admitted to a Veterans Administration hospital with a diagnosis of rheumatic valvular heart disease. After fluoroscopic examination and localization of intracardiac calcifications and by spot roentgenograms, the following valvular calcific lesions were found: aortic 21, mitral 15, and both 3. In the aortic cases there was no correlation between the degree of valvular calcification and the severity of the clinical symptoms; with the mitral cases there was a definite correlation, and the length of survival after discovery of mitral valve calcification was short, few such patients living for more than a year. In 11 autopsied cases the presence and location of the calcific valves as seen roentgenologically was confirmed.

Several cases are presented in detail to illustrate the value of the roentgen demonstration of valvular calcification in cardiac diagnosis.—*Harold Fulton, M.D.*

GOYETTE, EDWIN M., and KEIRNS, MARVIN M. Angiocardiography in the localization of foreign bodies in the heart. *Am. Heart J.*, Sept., 1951, *42*, 362–369.

From Harken's experience with intracardiac foreign bodies in World War II, it has been found that the exact location of the foreign body within the heart determines whether or not surgical removal is technically possible. The authors have recently studied 4 casualties from the Korean War and performed angiocardiography to aid in localization of suspected intracardiac metallic fragments. In 2 of the cases, the contrast study showed that the fragments were not dangerously close to or within the heart or great vessels. One other patient was found to harbor a shell fragment in the heart which on oblique angiocardiographic films appeared to lie partially or wholly within the interventricular septum, a surgically inaccessible area. Angiocardiography aided in the management of the fourth case by demonstrating the foreign body to lie within the right ventricle and subsequent surgical removal of the metal confirmed this localization.

For angiocardiography the authors use a serial film device of the Schwarzchild type which permits serial roentgenograms at one to one and one-half second intervals. The relatively long interval is

necessary to allow separate visualization of the cardiac chambers in relation to the foreign body. The left oblique position was found to be the most useful, but slight changes in the degree of obliquity or position may be desirable, depending on the location of the fragment as determined fluoroscopically.—*Harold Fulton, M.D.*

Tori, Giulio. Cardioangiografia selettiva. (Selective angiocardiography.) *Ann. radiol. diag.*, 1951, *23*, 280–294.

The author uses the procedure advocated by Jönsson for visualization of the various chambers of the heart and large vessels of the mediastinum during heart catheterization.

The patient is prepared several hours before the procedure is to be carried out by a hypodermic injection of morphine. Then an opaque catheter (Cournaud type) is passed into the lumen of the left brachial vein under fluoroscopic control. When the tip of the catheter has reached the desired place either in the right atrium, ventricle or pulmonary artery, the contrast medium is injected. The largest size catheter possible is used and clotting of blood is prevented by infusion of a citrated solution. As the tip of the catheter enters the various chambers of the right heart or pulmonary artery, pressure and gas content studies are carried out.

With the tip of the catheter in the desired position, the contrast medium is injected. In children about 30–40 cc. of 70 per cent ioduron is injected and 50–60 cc. in adults. The period of injection should not exceed two to three seconds. A 100 cc. syringe reinforced with a metal jacket is used to withstand the pressure necessary for rapid injection.

Serial roentgenograms are taken at six to seven second intervals to record the arterial and venous phases of the pulmonary circulation. This technique also permits good visualization of the left chambers of the heart and aorta. The first set of films is taken in the anteroposterior position. A second injection of contrast medium is made with films taken either in the right posterior or lateral position.

The author warns against extrasystoles and possible cardiac muscle strain with this procedure. A general anesthetic sometimes is used to prevent the coughing which may occur as the contrast medium circulates in the pulmonary system.

The advantage of selective angiocardiography as compared with injection of the medium into the brachial vein is that better opacification of the right heart and pulmonary artery are possible since there is less dilution of the medium. This better degree of visualization in turn permits a higher percentage of correct diagnoses to be made.

The author fails to mention either mortality or morbidity by using this method. The many illustrations which accompany this article are convincing. An outstanding one is a case in which the tip of the catheter entered the duct of Botalli with visualization of the ductus and thoracic aorta during injection.—*P. E. Russo, M.D.*

Janker, R., and Hallerbach, H. Die röntgenkinematographische Darstellung der Tricuspidalatresie. (Demonstration of tricuspid atresia by roentgen cinematography.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1951, *75*, 393–406.

The advantages of recording the filling of the heart with contrast material on a "moving film" over the conventional "still" roentgenograms are discussed. All phases are demonstrated by cinematography while phases occurring between exposures are not shown by the rapid cassette changing technique.

Thirteen cases of tricuspid atresia were studied by angiocardiocinematography.

The heart silhouette is of left ventricular type with concavity in the region of the cardiac waist and a straight right heart border. The pulmonary vascularity is decreased and, in the left anterior oblique view, the contour of the right ventricle does not project anteriorly to the root of the aorta as it would in a tetrode.

Constant findings are atresia of the tricuspid opening and a patent foramen ovale or interatrial septal defect. These can be combined with (1) a hypoplasia of the right ventricle and pulmonary conus and defect of the interventricular septum, or (2) an almost complete atresia of the right ventricle and persistent ductus arteriosus.

Variations of these two main types are discussed and the cinematographic appearances are described in great detail. The possibility of studying several consecutive images without viewing the whole film strip proves the superiority of this type of examination.—*F. M. Reis, M.D.*

Abdomen

Van Hoek, Donald E., and Musselman, Merle M. Diaphragmatic hernia with severe anemia after transabdominal vagotomy. *J.A.M.A.*, Oct. 27, 1951, *147*, 857–858.

Von Hoek and Musselman report a case in detail of a woman who had a transabdominal vagotomy for duodenal ulcer. At that time the peritoneum was incised at the esophageal hiatus and not repaired. Ten days later no hernia was found on gastrointestinal study but this was first demonstrated four months later. Because of severe anemia the patient subsequently had a subtotal gastric resection and hernia repair (chronic scarring of duodenum, no gastric ulceration), at which time one-third of the stomach was found to have herniated and its wall was adherent to the mediastinal tissue.

The authors emphasize that hernia can be prevented by repairing the peritoneal defect at the time of vagotomy. Since this type of hernia has no sac, the tissues become adherent and incarceration is likely to occur. Strangulation and obstruction are prone to develop because of the narrow, firm margin of the defect. Anemia due to chronic blood loss may be secondary to gastric herniation.—*Martha E. Mottram, M.D.*

FELDMAN, MAURICE. Prolapso da mucosa gástrica no bulbo duodenal; problema para esclarecimento. (Prolapse of the gastric mucosa into the duodenal bulb; a problem for clarification.) *Rev. brasil. de gastroenterol.*, July–Aug., 1951, *3*, 395–402.

Attention is called to the still numerous controversial features of prolapse of the gastric mucosa into the duodenal bulb both with regard to the pathological entity of the disease and to its clinico roentgenological manifestations. The author points out that there still exists considerable confusion regarding the roentgenological criteria, especially concerning the different stages of prolapse, the incidence in the different age groups of the adult population and the possible utilization of cholinergic blockage in the diagnosis and possible treatment of the disease. The grade and extension of the prolapse depend, apparently to a large degree, on the peristaltic activity of the stomach. It may therefore be expected that agents of nerve blockage may change or eliminate the roentgenological phenomena of the prolapse as well as the symptoms of the patient. According to the author, no cases of prolapse of the gastric mucosa have been observed or described in the vagotomized stomach. Theoretically, no mucosal prolapse should occur if the stomach is atonic or dilated (as is the case after vagotomy) or if there is absence of peristalsis. This conclusion is based on the assumption that the principal factors responsible for mucosal prolapse are: (1) redundant gastric mucosa, (2) gastritis and (3) increased gastric persistalsis. The limited number of cases subjected to, and observed during surgery as well as the fact that prolapse of the gastric mucosa is usually not encountered at autopsy further complicates the solution of this problem. It is suggested that anticholinergic or nerve blocking agents may be useful diagnostically and therapeutically. The effect of vagotomy and mucosal collapse deserves further study.

The author concludes that "prolapse of the gastric mucosa is a controversial subject, the diagnosis of which is not shared by all roentgenologists and gastro-enterologists. The diagnosis of this condition, too frequently, is made without adequate positive roentgenographic data, and often without adequate clinical justification. A follow-up study of proven cases and further investigation is clearly indicated." —*Ernst A. Schmidt, M.D.*

LEVIN, EMANUEL J., and FELSON, BENJAMIN. Asymptomatic gastric mucosal prolapse. *Radiology*, Oct., 1951, *57*, 514–520.

One hundred asymptomatic patients were studied in an effort to determine the frequency of prolapse of the gastric mucosa into the duodenal cap. No reliance was placed on fluoroscopy but up to eight spot films were made of the duodenal cap. The criteria for diagnosis were concavity of the base of the cap, mucosal folds passing through the pylorus into the cap, and deformity of the base of the cap. Insufficient findings for diagnosis were slight concavity or indentations of the base of the bulb.

The authors call attention to the many normal variations in the appearance of the base of the cap and to the fact that the diagnosis of prolapsed mucosa is best made when the base of the bulb is markedly concave or when gastric mucosa is definitely visualized in the cap.

Eighteen of the 100 patients showed some degree of gastric mucosa prolapse while 8 showed marked prolapse.

The authors believe that the clinical importance of a roentgen diagnosis of gastric mucosa prolapse has been overemphasized but occasionally hemorrhage or obstruction may be a complication.—*C. A. Stevenson*, M.D.

BISSYLAS, SAVAS. Fistula gastroduodenale (bulbar); report of two cases. *J. Canad. A. Radiologists*, Sept., 1951, *2*, 48–50.

This is a report of 2 very interesting and unusual cases of spontaneous gastroduodenal fistulae. Both had their origin in large ulcers on the lesser curvature, 1 malignant as proved by autopsy, and the other presumably benign since the patient is still alive. Both fistulae occurred between the ulcer and the duodenal cap. Just before the estimated rupture both patients complained of extreme discomfort which rapidly subsided with great improvement in the general condition.

The fistulae are well illustrated in both cases.—*J. M. Dell, Jr., M.D.*

WINHAM, ARTHUR J., and PECHSTEIN, GEORGE R. Clinical and roentgen observations of a newly perforated peptic ulcer. *Radiology*, Oct., 1951, *57*, 551–553.

One-half hour after the roentgen visualization of a duodenal ulcer crater, perforation occurred with classical clinical findings. No undue pressure was applied curing fluoroscopy or filming but the case is of interest for barium could be demonstrated in the peritoneal cavity thirty minutes after the onset of symptoms. An upright roentgenogram fifteen minutes after the onset of symptoms failed to show air

beneath the diaphragm, but three hours later there was a large amount of air present.

Barium was still present in the peritoneal cavity two weeks following surgical treatment of the ulcer. —*C. A. Stevenson, M.D.*

Smoller, Saul, Schreiber, Herbert, and Scott, Beatrice. Trichobezoar as cause of intestinal obstruction in a two-and-a-half-year-old child. *Am. J. Dis. Child.*, Oct., 1951, *82*, 439–441.

The case which is presented in this report is notable because of the absence of a hairball in the stomach which is usually found in this condition. In a review of the literature, the case is the youngest with intestinal obstruction due to trichobezoars on record. Four important points were demonstrated in the history of the patient. There was a prolonged history of abdominal complaints. Signs of partial intestinal obstruction were present. The patient appeared chronically rather than acutely ill, despite the history. The temperature was low grade, and the pulse rate was only slightly increased.

Although intestinal obstruction was recognized as a strong possibility, the acuteness of the problem was masked by the intermittency of the attacks and by a long-standing history which was elicited. The authors think that knowledge of this pattern should prevent any unnecessary delay in surgical intervention.

The roentgenograms of the patient taken in the supine and upright positions before operation were interpreted as normal.

At operation two compressible masses, each measuring about 3 by 2.5 cm., were palpated in the terminal ileum. The bowel proximal to the masses was distended and the bowel distal to the masses was partially collapsed. There were no masses in the stomach.—*R. S. Bromer, M.D.*

Morrison, Samuel, and Feldman, Maurice. The healing of a primary duodenal ulcer with the later development of a gastric ulcer. *Am. J. Digest. Dis.*, Oct., 1951, *18*, 296–298.

Recurrence of a peptic ulcer is frequent, commonly anticipated, and abundantly discussed in the literature. Scant information is available, however, relating to a peptic ulcer occurring at a new site, following healing of the original ulcer. The authors' records indicate that this occurs more frequently than has been suspected.

Of 500 cases of peptic ulcer, 458 were duodenal, 21 were gastric and 21 more were combined gastric and duodenal.

Among the 21 cases of combined ulcers, there were 6 cases of gastric ulcer which developed after the original duodenal ulcer had been healed by clinical and roentgenological criteria. The time interval between healing and recognition of the new ulcer varied from one to twenty-seven years. All cases were studied over a period ranging from five to thirty years.

Thus attention is drawn to the fact that recurrence of ulcer symptoms does not justify the assumption of recurrence of the same ulcer at the original site.—*A. A. Brewer, M.D.*

Kaplan, I. W., and Shepard, R. M. Prolapse of the gastric mucosa into the duodenum. *J.A.M.A.*, Oct. 6, 1951, *147*, 554–560.

Prolapse of gastric mucosa into the duodenum is reported in incidences of 1–7.7 per cent of gastrointestinal tract examinations. The authors analyzed 41 cases in the literature which were proved at operation and add 3 unreported cases.

Prolapse is more frequent in the older age group and there is a predilection for the male sex. The clinical picture is variable and the symptoms are not specific. The latter are produced by a partial block of the pylorus by the redundant prolapsed mucosa that is intermittently pushed through the pyloric ring. Trauma to the mucosa can cause superficial erosions which might cause bleeding.

Roentgen examination is the most valuable aid in establishing a correct diagnosis. A central filling defect near the base of the bulb, giving a mushroom-like appearance, is the characteristic picture. Often gastric rugae can be traced into the defect. The condition must be differentiated from pyloric ulcer, hypertrophic gastritis, prolapsing gastric polyps, duodenal polyps, and carcinoma of the stomach. A definite diagnosis can be made only by exploratory laparotomy and gastrotomy.

All patients with a prolapsed gastric mucosa should have a trial of medical management, which should include a bland, soft diet and antispasmodic drugs. If they fail to respond to treatment in a month, an exploratory laparotomy is indicated. When surgery is indicated, excision of the redundant mucosa with pyloroplasty gives excellent results.—*Russell Wigh, M.D.*

Willy, Ralph G., and Drymalski, George W. Carcinoma of the tail of the pancreas; roentgenographic aspects—two case reports. *Quart. Bull., Northwestern Univ. M. School*, Fall, 1951, *25*, 276–278.

Carcinoma of the pancreas comprises 1 to 2 per cent of all carcinomas, the head of the pancreas being involved approximately three times more often than the tail of the pancreas. The roentgen findings are indirect as the pancreas cannot be visualized directly by roentgen methods. The indirect methods produce correct diagnosis in about 50 to 75 per cent of the cases.

Some of the roentgen findings in tumors of the

head of the pancreas are: upward and ventral displacement of the stomach and downward displacement of the colon; widening of the duodenal sweep; the reverse three figure, produced by invasion of the duodenum; partial duodenal obstruction; ulceration and filling defects in the duodenum; invasion of the lumbar spine causing a scoliosis; pressure effect in the barium filled stomach due to a retrogastric mass and also an increase in distance between the air-filled stomach and spine as seen in the lateral projection.

The roentgen findings in carcinoma of the tail of the pancreas include: displacement of the stomach to the right and occasionally upward producing an hour-glass deformity; elevation and limited excursion of the left leaf of the diaphragm; and invasion of the stomach and colon.

The authors' cases both had invasion of the transverse colon at the splenic flexure. The lesions were constricting in type simulating a primary malignancy of the colon.

The authors emphasize the need of barium enema study whenever cancer of the pancreas is suspected.—*C. W. Cooley, M.D.*

BLEICH, ALAN R., HAMBLIN, DONALD O., and MARTIN, DOROTHY. Left-upper-quadrant gallbladder. *J.A.M.A.*, Oct. 27, 1951, *147*, 849–851.

The authors report a case of left upper quadrant gallbladder which they say is only the fourth recorded as being found preoperatively by roentgenographic means.

They review a total of 11 cases reported in the literature and discuss gallbladder and duct anomalies in general. The conclusion that a 14 by 17 inch film of the abdomen be made in all cases of nonvisualizing gallbladder seems warranted.

The embryology of a left-sided gallbladder not in association with situs inversus is also discussed.

The question of whether a diseased left-sided gallbladder will produce left-sided symptoms is left unanswered.—*R. E. Kinzer, M.D.*

HALL, AUGUSTUS A., and MASEN, JOHN M. A test for the more accurate recognition of gallbladder and liver bile during diagnostic biliary drainage. *Ann. Int. Med.*, Oct., 1951, *35*, 812–819.

In some cases of diagnostic biliary drainage, liver bile may appear grossly as dark as gallbladder bile. This can give a false diagnostic impression, for if no crystals are found in the specimens assumed to be coming from the gallbladder, but which in reality may be coming from the liver, the interpreter may report that no calculi are present in the gallbladder, when they actually are present.

The authors have devised an iodine test to check whether the bile is from the liver or gallbladder. Diagnostic biliary drainage patients were given six tablets of priodax fourteen hours prior to their drainage. Cholecystograms were also made before and after biliary drainage. The gallbladder was seen to empty following drainage in all of the patients. The duodenal drainage bile was tested for iodine by a described method. Iodine was demonstrated in all fractions.

Two cholecystectomized patients were given the priodax, fourteen hours prior to drainage, and iodine was found in all fractions.

In a group of 4 cholecystectomized patients, in whom drainage was done thirty-eight hours after priodax administration, no iodine was detected.

A group of 9 subjects, with gallbladders, was given priodax thirty-eight hours prior to drainage and no iodine was detected in any fraction of liver bile. One specimen of blackish-brown gallbladder bile was negative for iodine, giving a false negative reaction.

The authors conclude that, in the majority of instances, the trained observer can differentiate gallbladder from liver bile during diagnostic biliary drainage. It appears that priodax is present in the liver at fourteen hours, but not at the end of thirty-eight hours.

The instances of failure in the detection of gallbladder bile by the iodine test would probably be less than the nonvisualization by roentgen examination following ingestion of priodax. Amounts of dye in the gallbladder bile, too small to give a roentgen shadow, may possibly be detected by this method.—*W. M. Roy, M.D.*

HYNDMAN, CHARLES F. Some physiological aspects of intestinal obstruction. *J. Canad. A. Radiologists*, Sept., 1951, *2*, 43–47.

A review of the physiology of intestinal obstruction and the roentgenological findings is given.

Four cases are presented illustrating (1) simple ileal obstruction from an adhesive band, (2) volvulus of the sigmoid colon, (3) volvulus of the cecum and (4) inhibition or adynamic ileus.

Attention is called to the so-called "sentinel loop" of dilated upper small bowel associated with acute pancreatitis as reported by Grollman. This has also been noted with acute cholecystitis and acute appendicitis.

Wangensteen is quoted as having shown that the source of intestinal gas is 68 per cent swallowed air, 22 per cent the result of diffusion from the blood stream and 10 per cent the result of fermentation.—*J. M. Dell, Jr., M.D.*

BENCHIMOL, NEWTON BURLAMAQUI. Desvio transversal do baço e compressão conseqüente do estômago. (Transverse displacement of the spleen with concomitant com-

pression of the stomach.) *Rev. brasil. de cir.*, Aug., 1951, *22*, 109–114.

The case of a twenty year old girl suffering from schistosomiasis and irrepressible vomiting for a period of four months is reported. The roentgen examination showed marked extrinsic compression of the upper portion of the larger curvature of the stomach apparently due to pressure from the spleen. As demonstrated by the ensuing laparotomy, the spleen, entirely normal in its dimensions, had rotated transversely on its axis and lay horizontally, fixed by perisplenitis and by traction of the infiltrated gastrosplenic ligament. The lower pole of the spleen acted in the manner of an irritating spur; the vomiting was due to reflex action. The patient was entirely cured of her symptoms by splenectomy. Basing his conclusions on anatomicopathological findings, as well as on the laboratory studies, the author believes that there was a connection between the pathologic process responsible for the displacement of the spleen and the schistosomiasis.—*Ernst A. Schmidt, M.D.*

Gershon-Cohen, J., Hermel, M. B., Byrne, R. N., and Bringhurst, L. S. Rupture of the spleen; roentgen diagnosis. *Radiology*, Oct., 1951, *57*, 521–528.

The diagnosis of ruptured spleen is important because of its high incidence and mortality rate. Promptness in making the diagnosis and in carrying out surgical treatment are essential to survival.

The positive roentgen signs in this condition are relatively few, are variable and may be absent altogether. These signs consist of dilatation of the stomach, prominence of the rugae in the cardia, serration of the greater curvature of the stomach and downward displacement of the gastric cardia and splenic flexure of the colon. Less frequently seen are displacement of the stomach to the right, elevation of the left dome of the diaphragm, compression of the fundus, obliteration or increased opacity of the splenic shadow and demonstration of free blood in the peritoneum or mesentery.

The authors suggest, as an aid in arriving at the diagnosis, obtaining oblique projections with filling of the stomach and colon with contrast medium, study of restricted motion of the left diaphragmatic dome during both phases of respiration and repeated studies to detect progressive changes.—*D. N. Dysart, M.D.*

Beranbaum, Samuel L. Fictitious pelvic mass. *Radiology*, Oct., 1951, *57*, 554–555.

The author explains the cause of elusive masses often observed on abdominal, and especially urological roentgenograms.

A survey film of the abdomen showed an ovoid left pelvic density. On a thirty minute exposure urogram, gas appeared in the center of the shadow, proving it to be intestinal. Figures of the roentgenograms showing the change are included.

This confusing shadow may be presented by any "hollow organ" which is contracted with no contents when seen on the roentgenogram in tangential projection.—*E. E. Seedorf, M.D.*

Gynecology and Obstetrics

Henderson, D. Nelson. The malignancy of special ovarian tumors. *Am. J. Obst. & Gynec.*, Oct., 1951, *62*, 816–826.

Special ovarian tumors which belong to the dysontogenetic or embryonic carcinoma group are generally considered to be of low-grade clinical malignancy. Exceptions to this generally held opinion have been encountered.

The author has reviewed the clinical histories, follow-up records, and pathologic material of 50 cases. These are made up of 40 cases of granulosa cell carcinoma, 7 of dysgerminoma, and 3 of arrhenoblastoma.

The clinical course of the granulosa cell group of neoplasms was extremely varied. Both early and late recurrences took place with histopathologically benign neoplasms. Half of the recurrences occurred after five years. With 1 exception all patients who developed recurrent tumors were over thirty-nine years of age. Poorest survival rate was obtained by oophorectomy, whereas 14 of the 17 patients who survived five years or longer were treated by bilateral oophorectomy and hysterectomy. High voltage roentgen therapy for recurrent granulosa cell carcinoma was ineffective in retarding the progress of the disease.

Despite the apparently favorable extent of the disease in the dysgerminoma group, 5 patients died from recurrence and only 1 survived for five years. All patients were treated by oophorectomy.

The rarity of the arrhenoblastoma and the inadequate follow-up records of reported cases make it difficult to estimate the malignancy of this tumor. One patient died of recurrence within a year. One patient developed a second arrhenoblastoma in the remaining ovary in four years, but remained well for eleven years after original oophorectomy. The third patient survived for seven years, following bilateral oophorectomy and hysterectomy.—*E. J. McDonald, M.D.*

Haynes, Earl R., and Wangner, Wm. F. Chondroangiopathia calcarea seu punctata; review and case report. *Radiology*, Oct., 1951, *57*, 547–550.

Routine antepartum roentgen studies of a pregnant woman who had previously delivered a stillborn achondroplastic dwarf were done and revealed a

similar skeletal deformity of the fetus. In addition, the roentgenograms demonstrated evidence of chondroangiopathia calcarea seu punctata in the fetus. This rare condition is characterized by the presence of stippled areas of calcification within the hyaline cartilage occurring during the late prenatal period of development or in early infancy.

The main disease to be differentiated from chondroangiopathia calcarea seu punctata is the stippled epiphysis associated with hypothyroidism. This condition appears later in life, is not so widely distributed and the calcific deposits are larger.—*McClure Wilson, M.D.*

CONLEY, JOHN W., and RAND, CARL W. Spontaneous subarachnoid hemorrhage occurring in noneclamptic pregnancy. *Arch. Neurol. & Psychiat.*, Oct., 1951, *66*, 443–463.

Twenty cases of spontaneous subarachnoid hemorrhage occurring in noneclamptic pregnancy are tabulated from the literature. Other cases associated with borderline eclampsia are mentioned but are not considered as strictly within this category. Eight new cases are contributed by the authors.

With the occurrence of spontaneous subarachnoid hemorrhage associated with pregnancy, it is imperative to determine whether or not toxemia is the causative factor in the bleeding. This is not always easy, but is most important when the signs of mild pre-eclampsia are present. Even with the various laboratory tests and other diagnostic aids at one's disposal, it is sometimes most difficult to distinguish between the eclamptic and the noneclamptic type.

In the presence of spontaneous subarachnoid hemorrhage, the patient's condition permitting, cerebral angiography is indicated. The optimum time for this procedure will depend on the total appraisal of the patient. As suggested by Wechsler and Gross, the procedure may sometimes be carried out during the active hemorrhagic phase. Because it offers the only reliable means of demonstrating the source of hemorrhage, it is believed that angiography should be employed, especially when mild pre-eclampsia may suggest a toxic basis. In some cases elimination of the cause may be life-saving. The appropriate time and mode of treatment of an accessible aneurysm or vascular anomaly will depend upon the judgment of the neurosurgeon. At times it may be carried out as a life-saving measure, regardless of the stage of pregnancy. Unless the actual source of hemorrhage is demonstrated, a conservative regimen, with absolute bed rest for several weeks, should be rigidly enforced.

The mode of delivery is the problem that faces the obstetrician. The majority of authors agree that cesarean section is the method of choice, as it obviates the strain of labor. Even though the majority of hemorrhages occurred before labor, it seems irrefutable that the physical efforts demanded by labor could well serve to precipitate a hemorrhage in a patient with a known vascular abnormality.

The maternal mortality rate was 42.9 per cent, including the 8 new cases reported. The fetal mortality was 26.3 per cent. However, in 4 instances no mention was made of the fate of the infant, which, if known, would necessarily alter this figure.—*E. J. McDonald, M.D.*

MEIGS, JOE VINCENT. Radical hysterectomy with bilateral pelvic lymph node dissections. A report of 100 patients operated on five or more years ago. *Am. J. Obst. & Gynec.*, Oct., 1951, *62*, 854–870.

The author favors a radical surgical approach for the treatment of cancer of the cervix uteri. Dissatisfaction with a twenty-five year experience with radium is the motivating factor. Among other reasons advanced in favor of surgery are the following: recurrences after irradiation, the problem of radiosensitivity and radioresistance, bowel injury, lack of sterilization of the lymph nodes and a difficult postirradiation convalescence.

A series of 100 cases personally operated upon between 1939 and 1946 are reported. There were no surgical deaths. Patients were very carefully selected as to build, physical condition and extent of the disease. This report deals only with Stage I and II cases. At the present time, the extent of the malignancy is no longer a contraindication to surgery. The physical condition rather than surgical curability determines the author's choice.

Of the 100 cases, there were originally 72 in Stage I with 61, or 84.7 per cent, surviving five years, and 28 in Stage II with 17, or 60.7 per cent, surviving. After a thorough review of the microscopic sections, 15 of the original Stage I cases were excluded as being carcinoma in situ. This leaves a final group of 85 cases. There were then 57 cases in Stage I with 46, or 80.7 per cent, surviving and 28 in Stage II with 17, or 60.7 per cent, surviving five years. The over-all rate was 74.1 per cent.

Of the 85 cases, 19, or 22.4 per cent, had definite lymph node involvement. Five cases, or 26.5 per cent, survived. The lymph node metastases were found in 17.5 per cent of the Stage I cases and in 32.1 per cent of the Stage II cases. The obturator and iliac chains were most frequently affected.

A brief description is given of the operative procedure which is to be distinguished from the Wertheim method. Particular emphasis is placed upon there being complete removal of the parametrium, pararectal, paracervical and paravaginal tissue.

The chief complication of this radical approach lies in urinary difficulties. Bladder function is quite seriously impaired. Many patients frequently fail to regain sphincteric control until a year postoperatively. There is a tendency to fistula formation (ureterovaginal), yet healing occurs despite non-

functioning homolateral kidneys. Fifty of the cases were followed with excretory urograms. There were 8, or 16 per cent, with failure of renal function. In only 1 case could this be explained by a cause remote to surgery (renal lithiasis). Another serious problem is created by the shortening of the vagina, but in only 1 case did this lead to marital trouble. There were no bowel complications, nor were there any true infections.—*F. W. O'Brien, Jr., M.D.*

Friedland, Lester M. Intracranial metastasis of sarcoma botryoides. *Arch. Neurol. & Psychiat.*, Oct., 1951, *66*, 491–493.

A case of sarcoma botryoides of the uterus in a Negro female, aged thirty-nine, with complete autopsy, is reported. The neoplasm contained both striated muscle and cartilage, in addition to mesenchymal connective tissue; was associated with fibroids; and metastasized to the cranial cavity.

The general mortality rate is 90 per cent despite surgical and roentgen therapy, the average duration of life being about one year. Death is usually due to hydronephrosis from ureteral obstruction or to cachexia from metastases.

The origin of mixed mesodermal neoplasm of the uterus is speculative, the chief theories being the two familiar ones of metaplasia with neoplastic formation and origin from embryonal rests or heterotopic tissue. Associated fibroids are present in about 8 per cent of cases. Such a low incidence would seem to exclude, at least statistically, origin from this group of benign neoplasms. Some observers have described cartilage, bone, and even striated muscle, in rare instances, in an otherwise normal uterus at autopsy. —*E. J. McDonald, M.D.*

Genitourinary System

Engel, W. J., and Warden, J. G. Congenital anomalies of the genitourinary tract as cause of obscure disease. *Cleveland Clin. Quart.*, Oct., 1951, *18*, 289–298.

The authors stress that suspicion of the presence of an anomaly of the genitourinary tract should be considered in any obscure abdominal complaint. Before subjecting a patient to surgery when the abdominal complaints are unclear, careful urologic investigation should be done. They advocate intravenous urograms first, followed by careful cystourethroscopic examination and ureteral catheterization when indicated. Several illustrative cases are presented together with the following simple working classification of anomalies of the upper urinary tract.

CLASSIFICATION

Kidney
- Position—
  - Malrotation
  - Ectopia
- Form—
  - Fusion—horseshoe, crossed, etc.
  - Infantile—aplastic, multicystic
  - Congenital absence
  - Duplex—triplex
- Vascular—
  - Aberrant artery
  - Anomalous vessels

Ureter
- Division—
  - Reduplication (partial, complete)
    - To upper renal pelvis
    - Ending blindly
  - Triple ureters
- Failure of developments (neuromuscular?)
  - Megaloureter, unilateral, bilateral
  - Congenital diverticulum
- Ectopic opening—
  - Male: urethra, seminal vesicle, vas deferens
  - Female: urethra, vagina, cervix, uterus.—*Norman Heilbrun, M.D.*

Bader, J. Eine Möglichkeit zur Darstellung der Nierenfunktion im Röntgenbild. (A method of demonstrating kidney function by roentgenograms.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1951, *75*, 462–470.

Intravenous urography as a method of testing kidney function is not considered very reliable. Considerable difference between it and the methylene-blue excretion test has been reported.

Demonstration of the time of first appearance of the contrast material in the calyces seems a better procedure, provided the intravenous injection of the contrast medium is done in less than two minutes; the amount and type of the injected material does not seem to matter. Serial roentgenograms are taken one minute after the injection and at intervals of one minute thereafter. From three to six localized roentgenograms of the kidneys are available for interpretation. The position of the kidneys is determined by the preliminary roentgenogram and localizing markers are placed on the Bucky table. The average time of first appearance of filling of the calyces is three minutes; in some normals it may be five minutes.

This type of examination was done in 51 cases. The theoretical assumption that inflammatory diseases lead to decreased excretory function on the affected side seems to have been proved by the results obtained. The method may be of value in the early diagnosis of tuberculosis of the kidney before anatomical changes are roentgenologically demonstrated.

This roentgenographic kidney function test can be easily done without additional apparatus and at a very small additional cost. Further studies in this direction are planned.—*H. W. Hefke, M.D.*

RICHES, E. W. A case of cavernous haemangioma of the bladder. *Brit. J. Urol.*, Sept., 1951, *23*, 204–208.

Hemangioma of the bladder is a rare condition as evidenced by only 43 reported cases. More than half of the cases are under twenty years of age and the main symptom is painless hematuria. Partial cystectomy is the treatment of choice in most cases.

The author reports a case of cavernous hemangioma of the bladder in a boy 9½ years old. The patient had been treated since the age of four with fulguration at intervals of six months until the age of 7½ years. The patient was free of symptoms for two years. Fulguration did not control the recurrent bleeding and a partial cystectomy was done. There has been no evidence of recurrence at the end of two years.

The article is concise and well illustrated.—*A. E. Imler, M.D.*

BOREAU, J., ELBIM, A., HERMANN, P., VASSEL, B., and FUA, R. L'épididymographie. (Epididymography.) *Presse méd.*, Oct. 24, 1951, *59*, 1406–1407.

For some time, vesiculography has been successfully employed for visualization of the upper genital tract. The present report concerns attempted visualization of the lower tract including the original part of the vas deferens, the tail of the epididymis, the epididymis and the testicle. The pathology of these structures is rich and often not susceptible of clinical diagnosis. It was shown by performing the examination in individuals whose genital tract was already lost due to disease (prostatic neoplasm), that the contrast substance did not damage the mucosa and that catheterization was not traumatizing.

The genital tract from testicle to urethral meatus might be studied in cancer and adenoma of the prostate, testicular cancer, epididymal cyst, stones of various etiologies in the tail of the epididymis. The tract could be outlined precisely in traumatic and infectious strictures. The study of masculine sterility was also considered, including the ectopic testicle. There has been a contribution also to the understanding of the physiology of the tract. Pressure changes likewise might be studied by sensitive apparatus since they are small due to the powerful muscles. Furthermore, they can be studied only in conjunction with the visualization of the tract. The method of choice in visualizing the ejaculatory duct is catheterization and retrograde injection. Very careful endoscopy is necessary, along with fine catheters and a favorable local anatomy. Rarely are vesicular and ampullary injection achieved at the same time. Only exceptionally is the epididymis filled. The latter most often is approached through the vas deferens at the root of the sacs under local anesthesia. Through a 3–4 cm. incision, the vas deferens is isolated and a small trocar is introduced; 0.2 cc. diiodone (70 per cent solution) is injected followed by another 0.1 cc. if no stricture is found; 0.4 cc. must not be exceeded for the epididymis. This disappears in two to three hours.

The procedure is simple if done gently and aseptically but should only be employed when there are likely to be useful results.—*M. L. Sussman, M.D.*

RICHES, E. W., and CULLEN, T. H. Carcinoma of the urethra. *Brit. J. Urol.*, Sept., 1951, *23*, 209–221.

Carcinoma of the urethra is uncommon with a total of less than 400 cases reported of which almost 70 per cent occurred in women.

The authors report a series of 34 cases with 15 in the male and 19 in the female. Nine of the cases are alive and free of disease for one or more years and of these 7 are from a group of 9 cases in the anterior urethra. About 50 per cent of the cases show inguinal metastases when first seen by the physician. The lesions of the posterior urethra have a poor prognosis.

The 34 cases reported by the authors are well illustrated and concisely described.—*A. E. Imler, M.D.*

REICH, WALTER J., NECHTOW, MITCHELL J., and KURZON, ALVIN M. Urological disorders related to and clinically simulating gynecological pathology. *Urol. & Cutan. Rev.*, Oct., 1951, *55*, 587–591.

The intimate anatomical relationship of the genital and lower urinary tracts often predisposes to harmful effects in one when abnormal processes are present in the other. This may cause confusion in differential diagnosis. In clinical practice, it is well known that some diseases of the urinary system may give rise to gynecological symptoms and, conversely, disorders of the genital tract give rise to urological complaints. In this article, the authors discuss urethritis, urethral diverticula, cystitis, neurogenic bladder, urethrocystitis, ectopic kidney and nephroptosis, as they may affect one or the other system. Effect of pregnancy on the urinary system and the congenital anomalies which are so frequently associated in the two systems are noted to be of significance in this article.

Illustrations are shown of (1) a large stone in the pelvic ureter which was, on pelvic examination, interpreted as being a fibroid of the uterus; (2) an ectopic right kidney located in the pelvis and easily confused with an ovarian cyst; and (3) large renal calculi in a left kidney associated with an obstructed ureter from a calcified fibroid of the uterus.—*G. W. Chamberlin, M.D.*

CROMER, J. KEITH. Partial pelvic evisceration in the treatment of carcinoma of the cervix invading the urinary bladder; report based

on the results obtained in twelve cases. *Urol. & Cutan. Rev.*, Oct., 1951, *55*, 585–587.

Twelve patients with advanced pelvic carcinoma involving the bladder or vagina or both were treated by partial pelvic exenteration. Eleven of these had primary epidermoid and 1 had adenocarcinoma. The patients were prepared by blood transfusions and sulfasuxidine. At operation the ureters were implanted into the rectosigmoid. The rectum was preserved, but a radical hysterectomy and pelvic evisceration with lymph node dissection and removal of the bladder and vagina were attempted.

There were 4 immediate deaths: 3 within thirty days and 1 on the thirty-fourth day. Two patients died from pyelonephritis and uremia; 1 from a pulmonary infarct; and in 1 the cause of death was not satisfactorily explained at autopsy but may have been due to an electrolyte imbalance. Of the survivors, 5 are alive and well without evidence of disease from three to thirty months. Two are alive with the disease at fourteen months and six months. The authors feel that from the patient's standpoint in the advanced case where radiological and standard surgical procedures have failed, any method which offers hope merits consideration.—*G. W. Chamberlin, M.D.*

Blackwood, James. Presacral perirenal pneumography. *Brit. J. Surg.*, Sept., 1951, *39*, 111–119.

Presacral perirenal pneumography is a safe procedure and will adequately outline the kidneys and suprarenal glands. Air is injected in the loose areolar tissue in the presacral hollow posterior to the rectum and allowed to diffuse upwards in the retroperitoneal space outlining those structures found there. It does not hold the danger of air embolism as does the older method of perirenal insufflation by needle inserted in the lumbocostal angle. The air in the retroperitoneal space is absorbed in about ten days. The authors have employed it successfully in 15 cases without a serious untoward effect. They carefully outline their technique of injection.—*Joseph Levitin, M.D.*

Nervous System

Davies, Hugh, Reid, R. G., and Tutton, G. K. Discussion on myelography. *Proc. Roy. Soc. Med.*, Oct., 1951, *44*, 881–893.

Sicard and Forestier performed the first myelogram and demonstrated a spinal cord compression. Following publication of their paper in 1928, myelography became fairly widely used. Various techniques have been developed, but the contrast medium of choice in the United States and England is pantopaque. Camp states that lumbar myelograms employing air for contrast medium has its uses, but is limited in application and requires an experienced examiner. Camp believes lipiodol has given him more accurate information than pantopaque or other agents. He believes this to be the medium of choice in the demonstration of thoracic lesions. Ethyl iodophenylundecylate (the author believes) is the most generally useful medium for myelography.

More mistakes have probably been made in diagnosis of myelograms by the use of inadequate amounts of contrast medium than any single cause. Six cubic centimeters of contrast material is essential in the average case. This allows visualization in the lumbar region of at least two vertebral segments simultaneously. The whole cervical region may be visualized with this amount. When there is clinical or manometric evidence of a block, it may be reasonable to use a smaller amount.

For the past five years, the contrast material has been left in situ, except in a very few cases where a large quantity (10 cc. or more) of contrast material was used.

The examination is performed by introducing the contrast material intrathecally by lumbar puncture while the patient is on the roentgenographic table or in the ward. The patient should be positioned so that the opaque medium remains in the lumbar region. The roentgenograms are made with the patient in the prone position and supported by padded shoulder rests. The table is angled to place the medium in the desired interspace.

Myelography is indicated for localization of a lesion where the clinical level is doubtful; to show or exclude multiple lesions, either neoplasm or protruded disc. Except where clinical signs cannot be correlated with the findings on plain roentgenograms, a myelogram is neither necessary nor desirable as a routine in lumbar disc protrusion. Myelography is indicated to afford evidence as to the extent of a space occupying lesion and as to whether it is likely to prove intra- or extramedullary at operation.

The most difficult problem in myelography is the correct assessment of partial defects, especially when the contrast material becomes fragmented into droplets. In any such case, screening is carried out in prone and supine positions, and may be repeated in the suspected area. An adequate quantity of contrast material is essential for satisfactory examination. All examinations should include the entire spine, even in those cases where there are only lumbar signs present.

Dr. R. G. Reid: The interthecal space is a hollow tube occupied by the spinal cord, paired spinal nerves and the suspensory ligaments connecting the pia and the arachnoid. The subarachnoid space, therefore, is very complex and offers ample opportunity for disturbance of free flow of contrast material. For this reason, a filling defect must be constant to be of significance. If there is a spinal deformity, the contrast material may break up into droplets.

With spinal deformity, it may be difficult to position it properly and pre-myelographic study of the patient may allow advantageous positioning of the patient during myelography. Most spinal tumors, with the exception of chordomas and metastases, do not infiltrate the surrounding bone and are benign. They may cause pressure manifestations which are reflected by early decalcification of bone with spinal erosion and destruction. Early changes may be missed on the preliminary roentgenograms although the changes are seen on retrospective examinations of the same films. The earliest change of bone erosion is usually found in the pedicles. The normal convex medial margins become flattened, later concave and finally disappear.

Spinal tumors are divided into intramedullary and extramedullary groups. The extramedullary group may be subdivided into intradural and extradural groups.

In the intramedullary tumor, in the absence of complete obstruction, there is produced a fusiform defect in the contrast medium with the greater defect at the mid portion of the tumor. If the obstruction is complete, a symmetrical concave filling defect in the contrast shadow is seen. Intramedullary tumors form approximately 20 per cent of all spinal neoplasms and are histopathologically similar to the gliomas of the brain. The most common is the ependymoma. It is slow-growing, often symptomless until of large size, and causes bone changes in a high percentage of cases. Other gliomatous types obtain large size without causing bone erosion; perhaps because of their rapid growth. The most common non-gliomatous intramedullary tumors are syringomyelic cavities. The angioma is a common and essentially intramedullary lesion which produces a characteristic filling defect. The nerve root sleeves appear larger in intramedullary tumors.

Intradural, extramedullary tumors form approximately 60 per cent of all spinal neoplasms. When nonobstructive, they form a sharply defined filling defect. It is exceptional to demonstrate them in this stage. Commonly, obstruction is virtually complete and only a "crescentic" defect of the tumor is seen outlined by the contrast material. Extramedullary tumors obliterate the nerve root sleeves. These tumors, as a group, frequently cause bone erosion. The most common among them, causing bone erosion, are the meningioma and fibroma. The meningioma is seen chiefly in the thoracic region and causes minimal bone changes. The neurofibroma may be visualized as a paravertebral soft tissue shadow with associated bone erosion.

Extradural tumors form approximately 20 per cent of intraspinal neoplasms. They produce paravertebral soft tissue changes and erode adjacent bone. The most common are meningioma, neurofibroma and metastatic carcinoma. The hemangioma produces characteristically striated vertebrae. The most common extradural tumor is the retropulsed disc. Myelography is not often used for lumbar disc lesions. Cervical myelograms are frequently done and in one-third of the cases operated upon no disc was found, although the myelograms in all suggested a partial block. Cervical myelography is performed by introducing myodil intracisternally, with the patient sitting up in front of the screen. This allows little time for small irregularities to be properly observed.

Mr. G. K. Tutton (neurosurgeon): 105 spinal lesions were seen and 60 per cent of the total had myelography performed. In this series, 80 per cent of the tumors had myelography. All cervical disc lesions were subjected to myelography and 15 per cent of the lumbar disc cases had myelography. The decision to operate was based upon clinical signs and symptoms in the lumbar disc cases. Air myelograms were performed approximately six times without substantial success. It should, however, be valuable for showing up the cord and its shift above and below the lesion.

Thirty myelograms were done by the cisternal route and 30 were performed with lumbar puncture. Cisternal puncture is used for all cervical and dorsal lesions above T-6. For lesions below T-6 the lumbar puncture is used.

A neurosurgeon is interested in the exact level of the lesion, relationship of the tumor to the cord, *i.e.*, extradural, intradural or intramedullary and whether it lies in front, behind or lateral to the cord or in an intermediate of one of these positions. Twenty-six of the 33 tumors had complete block and the exact site of the lesion could not be determined preoperatively. The picture is not always characteristic and an intradural tumor may appear to be extramedullary, or vice versa.

Indication for operation of a cervical disc syndrome is based on cord compression with pain and root signs in the arms and a positive myelogram. Cervical disc protrusions are placed in three groups: (1) anterolateral protrusions; (2) diffuse bulge without much root involvement—these lesions are more medially placed; (3) ossified types which may be a median bar or part of a bony ridge arising from the attachment of the annulus to the backs of the vertebral bodies.—*D. R. Bernhardt, M.D.*

Skeletal System

Perlman, Robert, and Hawes, Lloyd E. Cervical spondylolisthesis. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 1012–1013.

The authors quote Hadley who enumerated a number of congenital lesions occurring in the cervical spine among which were unilateral defects. They were unable to find any record of a case of bilateral pedicle defects with resulting spondylolisthesis. Four illustrative roentgenograms are shown.—*R. S. Bromer, M.D.*

Cohen, Jonathan. Osteopetrosis; case report, autopsy findings, and pathological interpretation; failure of treatment with vitamin A. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 923–938.

Cohen states that the disturbance in bone formation known as osteopetrosis has been the subject of considerable study during the last two decades. The etiology and pathogenesis remain obscure. His present report of a case with extensive autopsy study is offered as an addition to the anatomical descriptions already published.

The paper is profusely illustrated with pathological sections and with a roentgenogram of the lower extremities of the patient. After he reviews the evidence presented he suggests the following conclusions:

1. The bone lesions in osteopetrosis constitute the primary morphological abnormality of the disease. Hematopoietic deficiencies are the main source of disability, although these may bear no quantitative relation to the degree of bone involvement. Dietary and infectious influence may be of primary importance in the hematological picture.

2. The bone lesions in generalized osteopetrosis are best viewed as abnormalities in remodeling sequences leading to absence of marrow-cavity formation and retarded resorption of calcified matrix and spongiosa. These may be further due to abnormalities in the calcium salts or in the matrix which binds them.

3. The consequences of the delay in remodeling are the formation of conical chondro-osseous complexes and absence of a marrow cavity, which constitute the principal bone abnormalities.

4. The transverse lines in the metaphyses of osteopetrotic bones are fractures in various stages of healing. These presumably occur because of the increased fragility of the bones, particularly at the subepiphyseal region and in the areas where the cortex joins the chondro-osseous complex. The rapid repair of these fractures contrasts with the delay in remodeling sequences.

5. Vitamin A in prolonged high dosage had no observable effect on the course of the case reported in this paper.

Before arriving at these conclusions, Cohen noted that all bones are affected in osteopetrosis. The membranous bones show changes analogous to changes in bones formed from cartilage. This, together with the fact that all other connective tissues, including cartilage, exhibit no demonstrable lesion, focuses attention on the process of bone formation. Growth, while retarded, continues.—*R. S. Bromer, M.D.*

Wright, Peter B., Gernstetter, Sangwill L., and Greenblatt, Robert B. Therapeutic acceleration of bone age in osteogenesis imperfecta; case report. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 939–946.

The case reported in this paper is of interest because, as the authors state, it is an isolated instance in which bone age has been markedly advanced by treatment with sex hormones. Evidence for incriminating the endocrines in the causation of osteogenesis imperfecta is not conclusive. In the authors' case, a decided advance in bone age in all ossification centers resulted from estrogen-androgen medication, but there was no stimulation of premature epiphyseal closure.

Although there was a definite regression of the secondary sex characteristics in the ten months following the cessation of treatment with methyl testosterone and stilbestrol, no change was observed in the carpus and hand. Since the apparent stimulus was removed and the epiphyses had not closed, the authors assume that the skeletal age will be arrested until the chronological age approaches it. They admit that this may be mere speculation; nevertheless, there seems to be little reason to believe that this interlude of endocrine therapy will have significantly altered the patient's ultimate stature.

Although some cases of osteogenesis imperfecta in earlier years show advanced bone age, the girl patient reported in this paper did not. It is regarded by the authors as a striking clinical example, corroborating animal experimentation, in which the sex hormones have been shown to markedly accelerate osseous development in a patient with no endocrine dysfunction.—*R. S. Bromer, M.D.*

Valls, José, Ottolenghi, Carlos E., and Schajowicz, Fritz. Epiphyseal chondroblastoma of bone. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 997–1009.

This paper is a report of 7 cases of epiphyseal chondroblastoma of bone. This tumor has only recently been recognized as an entity. Its clinical and histopathological characteristics are well defined. Codman and Ewing called this tumor a chondromatous or calcifying variant of giant cell tumor. Geschickter and Copeland first believed it to be a chondroblastic sarcoma but they later modified this classification and considered it a benign or malignant chondroblastoma. Jaffe and Lichtenstein called it a benign chondroblastoma.

Epiphyseal chondroblastomas originate during the adolescent years, or just after epiphyseal closure has been completed. Since they have their origin in the epiphyseal cartilage they do not occur after growth has ceased and epiphyseal cartilage has disappeared. The authors' cases ranged from thirteen to eighteen years in age. The clinical symptoms were not characteristic. Pain and swelling were the most frequent complaints. The pain was usually moderate, but, if the joint was involved, arthritic pain was superim-

posed. Enlargement of lymphatic nodes was present in 3 cases. Pathological fractures were uncommon. General symptoms were absent.

The characteristic roentgenographic lesion was a round or oval well defined area of destruction in the cancellous bone. Some reaction to this destruction was often evident in the authors' series, but usually the border of the lesion was irregular, fuzzy or vague. The characteristic trabecular appearance and cortical expansion of giant cell tumor were absent. The position of the lesion in relation to the epiphyseal plate was variable. In 6 of their cases, the tumor was predominantly on the epiphyseal side, but one tumor invaded both the joint and the metaphysis. In 1 case, the tumor was entirely on the metaphyseal face of the epiphyseal cartilage. The lesion located in the talus in their series was mainly central but involved the posterosuperior border. Subperiosteal bone production occurred in only 1 of their cases.

Serial roentgenograms sometimes revealed growth toward the joint, and transarticular spread was observed in 2 cases, 1 involving the femoral capital epiphysis and the other the proximal epiphysis of the tibia.

The gross and microscopic findings are described in detail with fourteen reproductions of photomicrographs. The authors believe the basic cell of the tumor is a reticulohistiocytic cell with a tendency to differentiate into chondroblastic tissue and then into cartilage. The basic stromal cell and not the giant cell establishes the difference between this group of tumors and giant cell tumors. In the latter, fibroblastic differentiation may be seen, but never the sequence of cartilage formation. Their interpretation of the basic tumor cell as reticulohistiocytic is based primarily on the observation of all stages of transition between the tumor cell, the chondroblast and cartilage, and on the presence, evident by silver stains, of reticulo-endothelial elements and reticulum fibers surrounding the tumor cells and chondroblastic tissue.

In the 8 cases reported, conservative therapy was curative in all of them. If the lesion has penetrated the epiphysis and injured the joint cartilage, the authors consider that it should be excised and followed by bone grafts in order to make up for the loss of substance and maintain continuity of the limb. When a surgical approach is impossible, roentgen therapy may succeed in curing the lesion.—*R. S. Bromer, M.D.*

GARTLAND, JOHN J., JR., and WERLEY, CHARLES W. Evaluation of healed Colles' fractures. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 895–907.

An analysis of a series of cases of healed Colles' fractures was made for a twofold purpose according to the authors: to determine, if possible, what factors are responsible for unsatisfactory results, and to evaluate a method of treatment widely advocated and commonly used. The fractures in their series were treated at an active general hospital by general surgeons, orthopedic surgeons and resident surgeons. Their follow-up results are believed to be representative of end results obtainable in any institution in which this fracture is similarly treated and studied.

The fractures were divided into three groups on the basis of roentgenograms made before reduction. Group I consisted of simple Colles' fracture with no involvement of the radial articular surface. Group II included comminuted Colles' fractures with fractures of the radial articular surface in which the fragments were not displaced. In Group III, the fractures were comminuted with fractures of the radial articular surface in which the fragments were displaced.

The behavior of the actual fracture components themselves was investigated. This included the dorsal tilt of the fragments as shown in roentgenograms, radial deviation, shortening, and loss of the integrity of the distal radio-ulnar joint. The efficiency of mobilization was also studied. Among the unwelcome complications of Colles' fracture, they found stiff fingers and arthritis of the wrist joint.

The authors conclude that the type of Colles' fracture incurred bears a definite relationship to the end result obtained. In a comminuted fracture, the threat of traumatic arthritis is always present. The basic nature of the fracture must be considered a factor in the prognosis. Their study of the fracture components demonstrated that the original reduction in all cases was inadequate. Sixty per cent of their cases, when examined eighteen months after the injury, showed a fracture healed in a position typical of a fresh unreduced Colles' fracture. This was regarded as due to an inefficient and inadequate method of immobilization.

In spite of incomplete reduction and inadequate immobilization, the functional results at the time of the follow-up examination were found to be surprisingly good. Satisfactory functional end results were obtained in 68.3 per cent of the cases. They attribute this largely to the innate ability of the wrist joint to overcome and compensate for residual bony deformity. Studies of function have shown that a great deal of bone deformity must be present before any of the motions of the wrist are greatly compromised. They consider a total of 31.7 per cent of unsatisfactory results much too high for a fracture to be regarded lightly and for which treatment tends to follow a routine pattern.—*R. S. Bromer, M.D.*

TENG, PAUL, GROSS, SIDNEY W., and NEWMAN, CHARLES M. Compression of spinal cord by osteitis deformans (Paget's disease), giant-cell tumor and polyostotic fibrous dysplasia (Albright's syndrome) of vertebrae; report of four cases. *J. Neurosurg.*, Sept., 1951, *8*, 482–493.

Spinal cord compression by a lesion of the vertebra is most often the result of traumatic injury, metastatic carcinoma, infiltrating sarcoma, tuberculous spondylitis, pyogenic osteomyelitis, osteoarthritis, infiltrating leukemia or multiple myeloma. Primary osteogenic sarcoma and benign neoplasms of the spine rarely cause compression of the spinal cord. Although osteitis deformans (Paget's disease) is not an uncommon disease and frequently involves the spine, it rarely causes compression of the spinal cord. The incidence of osteitis deformans is approximately 1 to every 2,000 admissions at the Mount Sinai Hospital. Of 131 cases affected with the disease, only 1 had paraplegia as a result of spinal cord compression by the hypertrophic vertebra. Laminectomy is the treatment of choice. The authors include a tabulation of 37 cases of Paget's disease with spinal cord compression reported from 1923 to 1951.

In seventeen years, 2 cases of giant cell tumor of the spine with compression of the cord were encountered at the Mount Sinai Hospital. Giant cell tumor is relatively uncommon and comparatively rare in the spine. Laminectomy for decompression, followed by radiation therapy, gave satisfactory results in 6 recently reported cases reviewed by the authors.

The vertebrae are scarcely ever affected by polyostotic fibrous dysplasia, and involvement of the spinal cord has never before been recorded in this condition, to the knowledge of the authors. One case involving the dorsal spine with paraplegia is presented. The patient recovered after laminectomy. A review of the related literature is presented.—*J. D. Reeves, M.D.*

de Cuveland, E., and Heuck, F. Osteochondropathie der Spina iliaca anterior inferior unter Berücksichtigung der Ossifikationsvorgänge der Apophyse des lateralen Pfannenrandes (Gleichzeitig ein Beitrag zur Kenntnis der normalen Anatomie dieses Skelettabschnittes im Wachstumsalter). (Osteochondropathy of the anterior inferior iliac spine, with consideration of the ossification of the apophysis of the lateral rim of the acetabulum; also a contribution to the knowledge of the normal anatomy of this portion of the skeleton during growth.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Oct., 1951, *75*, 430–445.

The occurrence of an apophysis of the anterior inferior iliac spine has been the object of controversy. Anatomists, clinicians and roentgenologists do not agree, if it is normally present, as to when it forms, and when it unites. A roentgen study of the hips in 433 children and adolescents (9–20 years) with a special technique (oblique projection) has convinced the authors that there exists regularly an apophyseal nucleus of the anterior inferior iliac spine. It can be demonstrated during the second decade of life; earlier in girls than in boys. After the age of twenty it has united with the iliac bone.

Three cases of osteochondritis of the anterior inferior iliac spine are described. The clinical symptoms, course of the disease and the roentgen findings are presented. The roentgen findings are similar to those observed in Osgood-Schlatter's disease. Because of the sometimes not very marked abnormal changes, it is necessary to use clinical symptoms for confirmation, which are: local tenderness, pain in moving the quadriceps and occasionally pain during rotation, abduction and adduction of the leg.—*H. W. Hefke, M.D.*

Street, Dana M. One hundred fractures of the femur treated by means of the diamond-shaped medullary nail. *J. Bone & Joint Surg.*, July, 1951, *33-A*, 659–669.

This paper is a report of the use of a diamond-shaped nail for intramedullary splinting of fractures of the femur. The nail was designed by Dr. F. C. Hansen who with the author inserted the first four nails of this type. Two different methods were used for insertion of the nail. The first, the closed method, consisted of reduction of the fracture by closed manipulation under roentgenoscopic or roentgenographic control and insertion of the nail from above through the great trochanter. This method can be used only in fresh fractures and in ununited fractures in which the fragments have not been displaced since accurate reduction by manipulation must be obtained. The second method is the open one. The fracture is exposed and reduced under direct vision, and the nail is inserted either from above or retrograde through the proximal fragment. The indications for this procedure are given in detail together with the technique of the operation.

Street concludes that the simplest and most generally applicable method of medullary nailing is open reduction with retrograde insertion of the nail. In his series of cases, callus formation was unimpaired and the fracture united in all but 2 of 90 cases; in 17 of these, previous attempts at fixation had been unsuccessful. He believes disability is greatly reduced and the patients undergo less pain and fewer complications than when treated by other methods.—*R. S. Bromer, M.D.*

Cleveland, Mather, Bosworth, David M., Daly, John N., and Hess, Wallace E. Study of displaced capital femoral epiphyses. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 955–967.

This paper is a report of a study of a group of 20 patients with slipping of the capital femoral epiphysis treated conservatively, contrasted with a

group of 37 patients in whom internal fixation was employed. In the group of 57 patients, sixty-four hips were involved.

An early diagnosis by means of biplane roentgenograms and prompt treatment when hip complaints exist in the adolescent may prevent serious disability from severely displaced capital femoral epiphyses. In the authors' opinion, when the deformity is not too great, simple nailing without reduction secures the best results. In cases with acute slipping in which there is a definite trauma to account for the condition, the outlook may be poor and a waiting period after reduction may be necessary before internal fixation is undertaken. Wedge osteotomy of the femoral neck for the more severe displacements in slipped femoral epiphyses presents an excellent outlook if the wedge is removed from the neck entirely, while the head and epiphyseal plate are left intact and a portion of the neck remains attached to the plate. Aseptic necrosis of the femoral head occurred about equally in the series treated conservatively and the series treated by operative methods. The conclusion is reached that the outlook for securing a good or excellent result is greatly improved by the use of internal fixation.

The paper is illustrated with serial roentgenograms of several cases.—*R. S. Bromer, M.D.*

ROWE, CHARLES A. The danger of exposure to x-rays by the "blind-nailing" technique. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 967.

The purpose of this paper is to warn those doing hip-nailings by the "blind-nailing" technique of the danger to exposure to roentgen rays. The majority of techniques developed necessitate the taking of lateral roentgenograms. Usually the surgeon or his assistant holds the cassette for the lateral film. During a routine hip-nailing procedure, two 85 kv., 15 ma. roentgen-ray apparatus were used. Five sets of films were required. The vertical projections did not require radiation exposure to personnel, and for the lateral view, the cassette was held each time by the same person. Three pocket dosimeters were placed on his body and three film finger rings were placed on his fingers.

It was found that the person holding the cassette for five lateral films received the following dosage of roentgen rays:

Body: 35 milliroentgens at the belt line,
28 milliroentgens to the right side of the neck,
4 milliroentgens to the left side of the chest.

Hands: 950 milliroentgens to the right ring finger,
125 milliroentgens to the left ring finger,
130 milliroentgens to the left forefinger.

The author quotes the recommendation of the Atomic Energy Commission that 100 milliroentgens in any one day or a total of 300 milliroentgens in any one week is the maximum acceptable radiation which one person should receive. From his experiment, it appears that the individual holding the lateral cassette is receiving three times the safety dose. The use of leaded gloves, he states, is not feasible, because of sterile technique, but even with this precaution not more than two films per day or eight films per week should be held by any one person. Several mechanical lateral cassette holders have been devised of which any one can be used easily with sterile precautions. Consequently it is recommended that those who do hip surgery frequently with the aid of roentgen rays should employ one of these devices.—*R. S. Bromer, M.D.*

KAUFMAN, J. J. Cutaneo-osteovesical fistula; report of a case following fracture of the pelvis, rupture of the bladder, and hip fusion. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 1017–1020.

The case reported demonstrated multiple complications of a fracture of the pelvis with central displacement of the hip, culminating in a bizarre cutaneo-osteovesical fistula, two and a half years after the original trauma. Such fistulae following hip fusion produced by internal fixation or following hip-nailing for fractures of the femoral neck are singularly rare. It was felt that the bizarre fistula in this case was the result of the original bladder and urethral perforation with posttraumatic fixation of the vesical neck to the pelvis. It seemed also that the subsequent osteomyelitic process burrowed through the fracture site and into the bladder in the region of the primary tear. The healing of the fistula occurred after adequate drainage of the osteomyelitis and the soft tissue abscess of the hip. The absence of bladder calculi, obstruction at the vesical neck, and additional sequestra favored prompt resolution.

The fistula was demonstrated roentgenologically by injection of the cutaneous ostium but not by cystography.—*R. S. Bromer, M.D.*

HIRSCHTICK, ALLAN B. An anomalous tarsal bone. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 907–910.

The accessory tarsal bones were well described by Pfitzner in 1896 and Dwight in 1907. The author found no description of an accessory tarsal bone such as he reports. His patient was a five year old white boy. At operation a bony mass was removed from the foot. The proximal end of the bone formed a shallow articulation with the talus just above and anterior to the lateral tubercle. The concavity of the talus was roughly circular, measuring 7 mm. in diameter and approximately 3 mm. in depth. From

this joint, the anomalous bone curved downward and backward, forming a rough semicircle and articulating with the calcaneus just below and behind the sinus tarsi. The defect in the calcaneus was oval in shape and measured 14 mm. at its widest portion and 9 mm. across at its narrowest part. The anomalous bone itself resembled in shape half of an elongated doughnut with a small hole in the center. Gross and microscopic examination of the bony mass revealed it to be composed of normal osseous and cartilaginous tissues.

Because of the location of this anomalous bone, the name "os talocalcaneus" is suggested.—*R. S. Bromer, M.D.*

Middlemiss, J. H. Juvenile rheumatoid arthritis (Still's disease). *Proc. Roy. Soc. Med.*, Sept., 1951, *44*, 805–816.

The etiology of rheumatoid arthritis is a moot question. The importance of peripheral vascular disease, virus infection, absorption of toxins from focal infections, tissue hypersensitivity and other factors as possible etiologic agents has been stressed by various authors.

The pathological changes of the joints in rheumatoid arthritis consist primarily of marked proliferation of the synovial membrane, with hypertrophy of the connective tissue in the marrow spaces of the subchondral bone, and of vascularization and fibrosis of the joint capsule. All other changes are secondary to these. As the synovial tissue proliferates it forms a very vascular and fibrous granulation tissue which grows over the articular cartilage and then invades it, becoming completely adherent to it. When this inflammatory condition subsides, fibrosis results. If destruction of the articular cartilage has been extensive, the fibrous tissue may ossify, thus producing a bony ankylosis.

In the adult, the first roentgenological sign commonly described is a regional osteoporosis affecting all bones. This appears as an exaggeration of contrast between the shafts and the ends of the bones. Spindle-shaped swelling of the soft tissues about the affected joints may be seen. Attention has been drawn to the slight increase in the joint space due to effusion. When destruction of the articular cartilage occurs, the joint space appears diminished on the roentgenogram. As destruction advances, the joints may become completely disorganized due to the effect of contractures which develop at the same time. With destruction of the articular surface, ossification of the intra-articular fibrous tissue may occur with resultant ankylosis. Bone destruction may be seen at the ends of the long bones due to excessive synovial proliferation and invasion. The disease process may be arrested at any stage with some return toward normal bone density but with no reconstruction of the destroyed bone or cartilage. It is frequently possible to demonstrate a periosteal reaction along the shafts of bones near an involved joint. In the adult with insidious onset of the disease this finding is rare. In the acute case (Felty's syndrome) it may be possible to show this change conclusively. Periosteal reaction is more common in childhood. Often the first roentgen sign is periosteal reaction along the shaft of a metacarpal or metatarsal. Not all cases show this sign and frequently all that can be detected is a generalized osteoporosis involving the bones of the hands or wrist. Microroentgenography shows the osteoporosis is due to disappearance of some of the bone trabeculae. The osteoporosis, therefore, is not the result of decalcification, but of actual destruction of bone trabeculae. The widened intertrabecular spaces persist, there being no reconstruction of the bone trabeculae after the pathological process is arrested. The periosteal change is most commonly seen along a metacarpal or metatarsal often involving the entire shaft of the bone. It is usually observed on only the medial or lateral border, not both. The adjacent joints frequently show pronounced changes. The periosteal reaction may resolve or ossify. Resolution is rapid with complete disappearance in a few weeks.

This disease commonly affects the cervical spine in children. It is often seen in association with psoriasis.

Rheumatoid arthritis may influence growth in four ways: (1) there may be acceleration of epiphyseal growth or of growth of the ossific centers; (2) the epiphyses may prematurely fuse; (3) gross deformities may be produced by premature fusion; and (4) the juxta-epiphyseal parts of the shafts of the bones may show tapering. Premature fusion of the epiphyses occurs not infrequently in any involved joint. Coss and Boots observed an 11 per cent incidence of brachydactylia in their series of 52 cases. The brachydactylia is the result of premature fusion of the epiphyses of the bones of the hand.—*D. R. Bernhardt, M.D.*

Stack, James K., and Lockwood, Robert C. Pneumoarthrograms of the knee; an aid in the localization of internal derangement. *Arch. Surg.*, Oct. 1951, *63*, 486–495.

This study is based on 144 patients who were studied by means of pneumoarthrography. Of this number 107 underwent arthrotomy. In 75 of these the diagnosis was made from a combination of clinical and pneumoarthrographic findings. The lesions were confirmed at the time of surgical intervention. Nineteen of the patients in this group did not undergo arthrotomy.

In 27 cases in which there was a history of instability but not enough clinical evidence to warrant an arthrotomy, the pneumoarthrogram acted as a positive aid in establishing the diagnosis. Eighteen pneumoarthrograms gave no evidence of internal derangement. These cases were considered unsuitable

for arthrotomy. However, a sufficient period of follow-up has not elapsed to establish the correctness of these conclusions. There was a 4.7 per cent error.—*J. J. McCort, M.D.*

PUTSCHAR, WALTER G. J. Chondrodystrophia calcificans congenita (dysplasia epiphysialis punctata). *Bull. Hosp. Joint Dis.*, Oct., 1951, *12*, 514–527.

In this entity, multiple, small, calcified foci in the epiphyseal and other cartilaginous portions of the skeleton are present at birth. Most commonly, the femur, tibia, fibula, patella, and tarsal bones are involved, although the bones of the upper extremity, pelvis, vertebrae and ribs may be affected. The calcified foci are clearly distinguishable from ossification centers. This condition should not be confused with "stippled epiphysis" due to multiple ossification centers (either related or unrelated to hypothyroidism).

The disease is twice as frequent in females. Blood calcium, phosphorus and alkaline phosphatase were found to be normal in all cases so studied. The infant's features may resemble those of achondroplasia; bones may appear dense, cataracts may occur and scaling skin lesions resembling ichthyosis may be present.

In the case reported, the more marked change was noted in the patella. Microscopic examination revealed mucoid degeneration of the ground substance, with some loss of cellularity. Homogeneous calcification of minute areas of ground substance when in contact with vascular marrow channels seems to cause a proliferation of blood vessels and connective tissue.

The author reviews 32 published cases.

The cause for this disease has not been discovered; further study is warranted, perhaps particularly of the parathyroids.—*J. D. Reeves, M.D.*

HATCHER, C. HOWARD, and CAMPBELL, J. CRAWFORD. Benign chondroblastoma of bone; its histologic variations and a report of late sarcoma in the site of one. *Bull. Hosp. Joint. Dis.*, Oct., 1951, *12*, 411–430.

The authors give the following summary and conclusions of their article:

Six patients with benign chondroblastoma are reported. In 5 an epiphysis was the site of origin, but in 2 of that 5 there was extension into the metaphysis. The tumor was confined to the metaphysis in 1 patient. The location of the neoplasm was proximal tibial metaphysis in 1; distal femoral epiphysis in 2; proximal femoral epiphysis in 1; proximal humeral epiphysis in 2 cases. Four patients were male, 2 female.

The basic cell of this neoplasm is an embryonic chondroblast. Cartilage matrix may or may not be formed, depending upon the state of differentiation of the chondroblasts and upon the chronicity of the lesion. Fibrosis and ossification are found as manifestations of maturation in the lesion and attempt at spontaneous repair.

Treatment of the 6 cases was surgical curettage in 3; curettage followed by roentgen irradiation in 3. All healed promptly. At the site of a benign chondroblastoma of the humerus a chondrosarcoma developed three and one-half years after treatment by curettage and roentgen therapy. This complication is interpreted as the effect of irradiation on bone and as probably unrelated to the pre-existing benign lesion.

Since surgical intervention is necessary for establishment of the diagnosis in chondroblastoma, and since curettage alone is curative, it is unnecessary and unwise to employ roentgen rays in the treatment of this benign lesion of bone.—*J. D. Reeves, M.D.*

BRAILSFORD, JAMES F. Problems in bone pathology. *Bull. Hosp. Joint Dis.*, Oct., 1951, *12*, 1–21.

This paper communicates to the reader Brailsford's viewpoint concerning the diagnosis and treatment of bone lesions, particularly bone tumors.

He summarizes some of his previous publications and from them lists the following factors showing that biopsy carries certain important risks:

(1) The anesthetic.

(2) Cutting into the lesion and (a) dispersing the infection or malignant cells; (b) destroying the scaffolding on which the future reconstructive stability may depend; (c) altering the sequence of clinical, histological and roentgenographic changes by adding the unknown effects of trauma which may further contribute to the difficulty of interpretation of the unusual case.

(3) The dangers of erroneous interpretation which may (a) lead to mutilation of a patient with a lesion which would have resolved had efficient treatment been applied; (b) result in many months of delay in securing accuracy.

Against the concepts of those who think that a period of waiting to watch the behavior of a lesion jeopardizes the life or limb of the patient who has malignant disease, he also lists from previously illustrated accounts of cases the following points: (a) prompt amputation of very early lesions has failed to prevent early death from metastases; (b) prompt amputation has been advised on clinical and histopathological evidence of malignancy but prevented for one or other reason and the lesion has completely resolved; (c) prompt amputation of a malignant lesion has been prevented and months of delay have followed because the histopathological interpreta-

tion was that of a benign lesion; (d) localized resection of a tumor having clinical and histopathological appearances interpreted by recognized authorities as malignant has resulted in cure.

He raises the question as to whether or not early diagnosis and prompt amputation is the best we can do for malignant disease. He says that in his opinion progress toward cure in malignant disease will only come as we subject the patient with the lesion intact to possible remedial practice which comes short of irrevocable surgery. Pathologists have taught us how the structure of these lesions differs from the normal; it is now for the physician to show us how to restore such to the normal.—*Russell Wigh, M.D.*

Reynolds, Fred C., Oliver, David R., and Ramsey, Robert. Clinical evaluation of the merthiolate bone bank and homogenous bone grafts. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 873–883.

The authors of this paper remain convinced that the process of fixation and replacement is accomplished in a similar manner in autogenous and homogenous bone grafts, but they are not at all sure that the differences in time of union and the number of failures can be explained entirely on the basis of tissue specificity. There is reason to believe that some of the cells of an autogenous graft are capable of survival and of instigating this process and thus accelerating it when host capillaries reach the graft. This could account both for the more rapid union of the autogenous graft as compared with the homogenous graft and for the greater number of successes with autogenous grafts. They state that merthiolate-preserved bone does not compare favorably with autogenous bone grafts in that the process of fixation and replacement is definitely retarded, requiring prolonged protection with a higher percentage of failures (30.24 per cent in their series).

They believe that the merthiolate bone bank is a very satisfactory method of preserving bone. They have no evidence of sensitivity to the merthiolate or excess tissue reaction to merthiolate-preserved bone. The method is certainly easier and more economical of bone than the frozen bone bank.

The conclusion is reached that homogenous bone grafts should never be used in the treatment of major non-unions if there is any possibility of using an autogenous graft. The use of the bone bank should be reserved for those circumstances in which it is not feasible or advisable to use autogenous bone. These are:

1. When the available supply of autogenous bone does not fulfill the particular requirements;

2. When the taking of an autogenous bone graft will materially increase the hazard of the operative procedure;

3. In any condition where there is a chance that the graft will be lost by infection;

4. During the course of an operation when it is decided that a bone graft would be useful and when no previous plans for taking a graft had been made;

5. In those cases where the bank bone is used as an internal splint when the condition would not justify the taking of an autogenous graft.

The paper is illustrated by roentgenograms showing the progress of bone repair and regeneration in several cases.—*R. S. Bromer, M.D.*

Blood and Lymph System

Berlin, Nathaniel I., Lawrence, John H., and Lee, Helen C. The life span of the red blood cell in chronic leukemia and polycythemia. *Science*, Oct. 12, 1951, *114*, 385–387.

It is generally accepted that the anemia associated with leukemia and neoplastic diseases is not completely understood. Infiltration of the bone marrow, with crowding out of the erythropoietic tissue, has been postulated as a significant factor in the pathogenesis of this anemia. However, Huff and co-workers have shown with radioactive iron that in some patients with leukemia the rate of production of red blood cells was greater than the 0.8 per cent per day that would be anticipated if the cells lived a normal life span of approximately 120 days. These same workers demonstrated that in polycythemia vera the rate of red cell production was much greater than 0.8 per cent per day. These findings (according to John H. Lawrence and co-workers) may be explained by postulating a decrease in the life span of the red blood cell in these diseases.

C^{14} labeled "glycine" has been shown to be satisfactory for the labeling of rat hemoglobin and for the determination of the life span of the red blood cell of the dog and rat.

Therefore, studies were carried out utilizing C^{14}-methyl-labeled glycine to determine the red blood cell life span in 3 patients with chronic leukemia (1 with lymphatic and 2 with myelogenous) and 2 patients with polycythemia vera.

It was shown that the red blood cells in 1 patient with chronic lymphatic leukemia in clinical and hematological remission at the time of these studies had a normal mean life span (110 days), and that in the 2 patients with myelogenous leukemia who were anemic there was considerable shortening of the mean life span of the red blood cell, from a normal of approximately 120 to 71 and 76 days respectively. If the bone marrow in these patients continued to produce a normal number of red blood cells per day, and if these lived only 70 instead of 120 days, it is then evident that these patients must become anemic. Therefore, in leukemia, a significant factor

in the pathogenesis of the anemia is the decrease in the life span of the red blood cell.

In the 2 cases of polycythemia, it was found that there was one class of red blood cells that had an almost normal life span and a second class of red blood cells with a life span of only a few days (it is assumed that in both classes of red blood cells the hemoglobin within the cell is not exchangeable and that the removal of the hemoglobin and the red blood cell from the circulation is the same process). According to the writers, it is the "rapid turn over" of the short-lived red blood cells that is largely responsible for the greatly increased rate of utilization of iron for the formation of hemoglobin in polycythemia vera.

The writers add that "since the submission of this manuscript (May 1951) three additional patients with chronic leukemia have been studied and found to have red cells with decreased life span."

The authors believe that the above studies may necessitate a revision of the present concept of the mechanism of the anemia occurring in neoplastic disease.—*R. F. Neihaus, M.D.*

FOLLIS, RICHARD H., JR., and PARK, EDWARDS A. Some observations on the morphologic basis for the roentgenographic changes in childhood leukemia. *Bull. Hosp. Joint Dis.*, Oct., 1951, *12*, 67–73.

This is a study of certain observed morphological alterations and a correlation of such changes with the roentgenographic findings in childhood leukemia. Rarefaction, fractures, and periosteal changes are discussed respectively.

The most conspicuous alteration is *rarefaction*, which is usually diffuse, although localized areas may be observed within the cortex or medulla. Though the cause is obscure, the authors suggest that the diffuse rarefaction is associated with the general wasting and that the presence of cells in the marrow spaces must also be a factor both for the generalized as well as the localized change. It was noted that the areas in which the appearance suggested that the leukemic infiltrations were destroying bone were where the surface of contact was completely bare of its endosteal covering. Is the endosteal membrane then not essential in maintaining the integrity of bone? One feature which aided in the explanation of osteoporosis as seen on the roentgenogram was the presence of osteoid borders along trabeculae in a high proportion of cases. It would appear that the rarefaction is the result not only of fewer and smaller trabeculae but of insufficiently calcified structures as well.

Fractures are a consequence of the rarefaction. Such breaks may be localized or extend across the entire width of bone. They are found a few millimeters beneath the cartilage and involve bone trabeculae. They differ from the fractures of scurvy, which occur in calcified matrix just at the cartilage shaft junction. With healing, a zone of increased density extends across bone as a bright line.

The layering of the *periosteum* is also a prominent feature of leukemia. The reason for this, histopathologically, is leukemic infiltration. Lymphoid and myeloid cells are found between the periosteum and cortex; the latter may be thinned. The layering so characteristic on the roentgenogram results from the formation of new bone beneath the innermost layer of periosteal cells.—*A. W. Finestone, M.D.*

ABESHOUSE, BENJAMIN S., SCHERLIS, I., GOLDEN, M., and RUBIN, M. Aortography and renal arteriography following percutaneous retrograde catheterization of the femoral artery and aorta. *Urol. & Cutan. Rev.*, Sept., 1951, *55*, 517–528.

In this article the authors review the literature and present their evaluation of the method of percutaneous retrograde catheterization of the femoral artery and aorta based upon fifteen examinations on 13 patients. The method, according to them, fulfills the criteria and requirements for acceptance of any new roentgenologic procedure; namely (1) the procedure must be safe and simple to perform; (2) the cost must be relatively low; (3) the roentgen findings must be sufficiently clear and characteristic to permit accurate interpretation; (4) the findings must be adequate to serve as a satisfactory guide to treatment.

A comparison of translumbar aortography, retrograde catheterization of the exposed femoral artery, and percutaneous retrograde catheterization of the femoral artery shows that: (1) All three methods are relatively safe and afford excellent visualization of the aorta and renal arterial tree under ideal conditions. (2) The translumbar aortography is simpler and quicker to perform but requires general anesthesia. The possibility of local or systemic reactions or complications appears to be greater with this procedure. (3) The chief advantage of retrograde arteriography by the open or closed method of catheterization lies in the ability to place the catheter accurately at any desired level in the aorta. (4) The percutaneous method of retrograde aortography is easier to perform than retrograde catheterization of the exposed femoral artery or any of its deep branches. The latter method is time consuming and has a disadvantage of permanently interfering with the deep arterial supply to the upper portion of the thigh and buttock as a result of ligation of the lateral circumflex branches of deep profunda branch of the femoral artery.

The method recommended by the authors is briefly as follows: A No. 12 gauge needle is advanced directly into the femoral artery so that the beveled

surface of the needle cuts the artery longitudinally. About 10 cc. of heparinized saline solution is injected and a three way stopcock is closed. A polyethylene catheter, which has previously been sterilized, is passed into the stopcock which is then opened to permit the passage of the catheter up the femoral artery for the required distance of 18 to 20 cm. Under no circumstances should the catheter be forced as such action may lead to kinking or cutting of the catheter or damage to the vessel wall. Accurate determination of the desired level is made by taking a roentgenogram after injecting 2 cc. of 70 per cent diodrast. This also serves as a test for sensitivity to the drug. For good renal arteriograms, the tip of the catheter should be placed 1 to 2 cm. above the level of the renal arteries, which is approximately at the level of the junction of T12 and L1 vertebrae. The polyethylene catheter is kept filled with diluted heparinized saline to prevent clotting. The needle is removed from the femoral artery by sliding it back along the catheter. Bleeding is controlled by pressure over the site of the puncture for five minutes. The roentgenographic examination is then carried out after the injection of 20 cc. of 70 per cent diodrast. This injection is made within the period of two seconds. A single exposure is made after completion of the injection and a second film three to five minutes later. A third film is then exposed eight to ten minutes later.

The authors have had but one complication. In this instance, one of the polyethylene catheters broke off in the iliac artery. This was attributed to a rough or sharp area in the No. 12 needle, and was thought to have cut the catheter as it was passed through the lumen of the needle. Illustrations which are shown of the aortography and renal blood supply are of diagnostic quality and, according to the authors, of diagnostic value.—*G. W. Chamberlin, M.D.*

General

Dickinson, Joshua C. General practice of radiology. *J.A.M.A.*, Oct. 20, 1951, *147*, 709–711.

From the vantage point of thirty years' experience in the private practice of radiology the Chairman of the Section of Radiology of the American Medical Association has several interesting comments to make covering the present and future of the specialty.

In dealing with the functions and obligations of the radiologist, it is pointed out that the latter should be a consultant in the fullest sense rather than a specialist whose practice is limited to a narrow field. To render this aid the radiologist must be sufficiently interested and have sufficient time to take the history, make a physical examination and display a real interest in the patient and the problem presented. If the examination is carried out in this way the patient knows he has seen a doctor and will know the doctor's name, information of which he is commonly unaware when he is seen in institutions.

No value is seen to be present in the division of radiology into diagnostic and therapeutic specialties. It is aptly pointed out that in the forseeable future this division is not feasible in the average community.

With regard to residency training, the author emphasizes the importance of the candidate's training as a doctor first. It is felt that the average young physician has not been exposed to enough general medicine at the end of one year to know what he wants to do in the special fields.

Regarding the decision for the private practice of medicine versus hospitals, the author has this to say: The practice of radiology will be best safeguarded in the future if radiologists conduct their practice in private offices rather than move it into a hospital. The physician-patient relationship can be maintained in a private office. The patient knows that he is seeing a medical consultant and not being examined in some hospital department where all too often he does not see or know the consultant who is responsible for the examination and for whose services he pays a professional fee.

The author has managed to give a thoughtful and well considered answer to some of the questions perplexing the specialty of radiology. For a sound viewpoint on the future of radiology, it is recommended that prospective residents or residents in training read this address in its complete context.—*J. J. McCort, M.D.*

Spillane, John D., and Lloyd, Geoffrey H. T. Spastic paraplegia in late adult life; with degeneration and protrusion of cervical discs. *Lancet*, Oct. 13, 1951, *2*, 653–658.

The discussion pertains to 12 cases, 10 men and 2 women. Youngest in the group was fifty-four and the oldest seventy years of age. Duration of symptoms ranged from four months to five years. History of injury was present in only 1 patient.

Essential feature of the clinical picture was the slow development of a spastic paraplegia, occasionally a quadriplegia. Neck movements were normal and painless in all cases. In each case the plain roentgenograms showed evidence of osteoarthritis with osteophytes projecting into the intervertebral foramina and spinal canal. A consistent finding was also evidence of narrowing of the intervetrebral interspace or interspaces at the level of the lesion. Opaque myelography gave positive evidence of disc protrusion in 11 patients.

The disc protrusions bulging into the spinal canal produced ridges which compressed the spinal cord and thus caused abrasive effects on the cord resulting

from friction against this abnormal surface of the spinal canal. The clinical features which result from this process vary considerably and may resemble those of common degenerative affections of the spinal cord.—*E. A. Addington, M.D.*

RADIATION THERAPY

BONSE, G. Über eine angebliche Wachstumsstörung der linken Scapula als Folge der Röntgen-Nahbestrahlung eines Haemangioms. (A case of alleged retardation of growth of the left scapula following contact roentgen therapy of hemangioma.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1951, *75*, 93–95.

The author had the opportunity of re-examining an eleven year old girl who had been treated in the Dermatological Clinic, University of Würzburg, with contact roentgen therapy ten years previously for a cavernous hemangioma in the region of the left scapula. The mother brought the child in because she had the impression that the left scapula "was not growing normally." Between August, 1940, and June, 1941, a total of 3,500 r in single doses of 550 and 750 r were administered. Technique: 50 kv., 2 cm. focus skin distance, no filter, diameter 2.5 cm. (round cone), two fields above the inferior angle of the left scapula. A checkup in 1942 revealed that the hemangioma had completely disappeared; there was atrophy of the skin and some telangiectasia. Re-examination now showed identical findings in the skin; the atrophic area was located about 2–3 fingers below the inferior angle of the left scapula. Most noticeable was a perspective shortening of the left scapula. In order to establish a definite diagnosis, the patient was sent to the various specialty clinics. One consultant concluded that this was a case of delayed growth due to late roentgen injury; another stated that the probability of such an injury could not be denied.

Roentgen studies revealed the true nature of the underlying cause. A posteroanterior view of the left scapula with internal rotation and elevation of the left arm demonstrated a mushroom-like exostosis of walnut size attached to the inner surface of the inferior angle of the left scapula. The picture was therefore that of a "scapula elevata" simulating a shortening of the bone.

The author concludes that in this case no evidence of roentgen injury could be proved; he urges caution and thorough examination before arriving at such a diagnosis.—*E. A. Pohle, M.D.*

MARAÑÓN, DRES. G., and FLORES ESTADES, S. M. Diabetes insípida, ¿ de origen radioterápico? (Diabetes insipidus, of radiotherapeutic origin?) *Bol. Inst. Pat. Méd.*, July, 1951, *6*, 136–137.

Diabetes insipidus has been caused by unusual lesions. Mention is made of 2 cases, 1 caused by septic embolism to the posterior hypophysis and another apparently due to an angioma in the hypothalamo-hypophyseal area.

A case is presented of a nine year old boy who suffered a fall of about 3 meters, thereafter suffering a few minutes of unconsciousness, but having no apparent after-effects. Six months later he received roentgen therapy with unknown dosage for tinea of the scalp. A short time later he suffered personality changes and developed diabetes insipidus. Since no other cause could be found, the possibility that the syndrome of diabetes insipidus might be caused by the roentgen therapy is presented.—*C. M. Nice, M.D.*

PACK, GEORGE T., and MILLER, THEODORE R. Combined radiation therapy and surgical treatment of technically inoperable cancer. *Radiology*, Oct., 1951, *57*, 529–535.

Too often in the past, and to some extent at present, there has been controversy regarding indications for radiation therapy and for surgical intervention in treatment of carcinoma.

Although surgical procedures have been perfected there are still numerous carcinomas which are deemed inoperable because of local extent and technical difficulties. For these inoperable carcinomas, the combination of radiation therapy and surgical treatment is essential. Either method alone would result in failure. Irradiation frequently converts a technically inoperable cancer into one that is resectable. Results obtained have been palliative in every case and curative in many instances.

The list of cancers which are most advantageously treated by a combination of the two modalities includes the following: cancers of the rectum and colon which are fixed and immovable; certain fixed sarcomas of the soft tissues; cancer of the thyroid with extensive bilateral cervical lymph node metastasis; malignant tumors of the maxillary antrum with invasion of surrounding regions; ovarian cancer with ascites and a fixed tumor; lymphosarcoma limited to one node-bearing region.

In some cases a preconceived plan of irradiation is followed which will result in radiation necrosis and ulceration, calling for subsequent removal of the regressive tumors and the damaged tissue adjacent to it. This plan must be explained to the patient before therapy is started. A postirradiation interval of six weeks is necessary to permit maximal regression of the tumor prior to surgery.

Thirteen case reports are given as examples of different types of cases in which there was advantageous use of this combination of irradiation and surgery. They serve to emphasize the degree of palliation obtained in some and frequent long-standing cure in others.—*A. W. Sommer, M.D.*

Wookey, Harold; Ash, Clifford; Welsh, W. Keith; and Mustard, R. A. The treatment of oral cancer by a combination of radiotherapy and surgery. *Ann. Surg.*, Oct., 1951, *134*, 529–540.

The authors report the results of an extensive series of cases of "oral cancer" seen at the Toronto General Hospital from 1929 to 1945. This includes malignant lesions of the lip and oral cavity back to and including the anterior pillars of the tonsils and the base of the tongue. There were 1,128 lip cancers, 342 tongue cancers, and 497 cancers in other sites.

The average age was sixty-three years. Oral cancer is predominantly a male disease; 98 per cent of all lip cases and 80 per cent of the other intraoral lesions occurred in males. The lower lip is almost invariably affected. Oral cancer tends to be a local disease spreading to the lymph nodes of the neck, or involving bone by direct extension or as a result of associated infection. Autopsy studies show that although remote metastases do occur they are rare.

All cases were seen in a combined clinic comprised of the radiologic staff, representatives of the Department of Surgery and a dental consultant. The diagnosis was confirmed by biopsy and a plan of treatment agreed upon. In general, the treatment of the primary lesion was considered to be a radiologic problem with the following exceptions: First, where a lesion occurs on the dental ridge of the mandible with involvement of bone, surgical removal of part of the jaw together with the primary lesion is indicated. Second, a lesion which has failed to respond completely to irradiation, leaving residual carcinoma, or one that has resulted in a chronic ulcer, should be excised and followed by a plastic reconstruction when necessary.

Lymph nodes were involved in only 13 per cent of the lip cases, whereas in the tongue and other intraoral cases the involvement was 60 per cent. The submaxillary, submental, or deep cervical groups were involved, the latter much oftener from the intraoral lesions.

The authors feel that prophylactic dissections are justified in tongue and intraoral cases, particularly in the younger age group.

When a case is seen and there is evidence of lymph node invasion, plans are made for a neck dissection. All efforts are made to eliminate infection by dental extractions and other means. The primary lesion is then treated radiologically, and as soon as possible after this the neck dissection is done. Occasionally, if the lymph node involvement is extensive, the dissection is done first. If too extensive, palliative irradiation is given.

All modalities of irradiation are used—external and intraoral roentgen therapy, radium needles of varying lengths and intensities, and radium molds. Radon seeds are also used when indicated.

Good radiation therapy is based not only upon clinical judgment but also upon precise application of sound physical principles. Careful planning is needed to obtain a tumor-lethal dose with the least possible damage to surrounding tissues. To achieve this a combination of roentgen therapy and some form of radium application is often required.

Although lymph node involvement tends to be local in elderly subjects, it is felt that dissection when undertaken should be complete, *i.e.*, removal of the submaxillary salivary gland, sternomastoid muscle and the jugular vein. There is little disability with this procedure. When necessary, the other side may be dissected three or four weeks later, using certain precautions. The best results are obtained when the lymph node involvement is early.

When bone removal due to disease or radiation therapy is necessary, part or half of a mandible may be resected. This may be combined with dissection of the submaxillary triangle or even block dissection.

Practically all advanced cases are treated radiologically as a palliative means. Alcohol injections or sensory root divisions of cranial or cervical nerves may be carried out by the neurosurgeon for painful complications.

In view of the age group involved, both net and gross survival rates are tabulated for the three main groups of cases as shown in the following tables:

Table I

CARCINOMA, LIP, 1929–1945, 1,128 CASES

Average age	61.1 years	
Proportion of cases		
Male	97.4%	
Female	2.6%	
Involvement of lymph nodes		
On admission		50 (4.4%)
Later development		99 (8.6%)
Total		149 (13%)

Table II

CARCINOMA, LIP; FIVE-YEAR SURVIVAL RATES BY STAGE OF DISEASE, 1929–1945. NET SURVIVAL EXCLUDES UNTRACED CASES AND THOSE DYING OF EXTRANEOUS DISEASE

Stage	Number	Per Cent Net Survival	Per Cent Gross Survival
I	690	93.9	65.1
II	290	81.4	54.1
III	116	66.2	43.9
IV	32	7.7	6.3
Total	1,128	85.1	58.4

TABLE III

CARCINOMA, TONGUE, 1924–1945; 342 CASES

Average age	67.2 years
Proportion of cases	
Male	80%
Female	20%
Involvement of lymph nodes	
On admission	123 (35.9%)
Later development	80 (23.5%)
Total	203 (59.4%)
Wassermann reports positive	29 (8.5%)

TABLE IV

CARCINOMA, TONGUE. FIVE-YEAR SURVIVAL RATES BY STAGE OF DISEASE, 1924–1945. NET SURVIVAL EXCLUDES UNTRACED CASES AND THOSE DYING OF EXTRANEOUS DISEASE

Stage	Number	Per Cent Net Survival	Per Cent Gross Survival
I	55	81.0	61.8
II	114	55.4	44.7
III	121	26.9	23.1
IV	52	4.1	3.8
Total	342	40.1	33.6

TABLE V

ORAL CARCINOMA, EXCLUDING TONGUE AND LIP, 1929–1945, 497 CASES

Average age	63.5 years
Proportion of cases	
Male	90.9%
Female	9.1%
Involvement of lymph nodes	
On admission	130 (26.1%)
Later development	90 (18.1%)
Total	220 (44.2%)

TABLE VI

ORAL CARCINOMA (EXCLUDING LIP AND TONGUE); FIVE-YEAR SURVIVAL RATES BY STAGE OF DISEASE 1929–1945. NET SURVIVAL EXCLUDES UNTRACED CASES AND THOSE DYING OF EXTRANEOUS DISEASE

Stage	Number	Per Cent Net Survival	Per Cent Gross Survival
I	81	74.2	56.8
II	154	50.4	39.6
III	169	29.2	25.4
IV	93	8.9	8.6
Total	497	37.6	31.8

Although specific details of radiation therapy are lacking, the principles of the combined approach by the authors are well worth emphasizing and the paper should be read in its entirety.—*Norman Heilbrun, M.D.*

RESTREPO, ROBERTO. Cáncer del cuello uterine y su tratamiento con radiaciones. (Cancer of the uterine cervix and its treatment with radiation.) *Radiología*, Panamá, June, 1951, *1*, 180–188.

In eight years 1,729 patients with cancer of the cervix were examined: 1,108 in the National Radium Institute and 621 in the author's private practice. Of these, 822 (449 clinic and 373 private) were treated with radiation.

Although foreign authors consider the age of greatest disposition to be forty-five to fifty years, in Colombia cancer of the cervix occurs most frequently between forty and forty-five. This may be attributable to the tropical climate and earlier maturity in women. The number of children or pregnancies does not seem to be of great importance. As would be expected in Colombia, private patients have more children than clinic patients. Only 2 instances of carcinoma of the cervix were seen in virgins.

The Paris system of irradiation was used in this series. A uterine tube and colpostat containing radium were applied for one to two weeks for a total dose of 8,000 mg. hr.

Roentgen therapy was given immediately after the radium was removed. When the tumor was exophytic it was electrocoagulated before radium was inserted.

The roentgen therapy was administered through six portals, two anterior and four posterior for a total dose of 14,000 r (air) in fifty to ninety days. The radiation factors were: 190 kv., Thoraeus filtration, and fifty to seventy cm. focus skin distance. Field sizes varied from 300 to 400 $cm.^2$

The author feels that prolongation of the treatment time will spare the viability of the skin, but may also spare the viability of the cancer cells.

Interstitial radium needles were used in several cases, but the method was abandoned as perilous.

Proctitis occurred in no less than 80 per cent of the cases. This is a greater incidence than is reported by foreign authors, and is attributed to the prevalence of intercurrent amebic colitis in Colombia. Private patients had a lower incidence of proctitis and this may be partially ascribed to the greater filtration of radium (2.0 mm. Pt) in these cases. The filtration in the clinic cases was 1.5 mm. Pt.

Pyometrium is the most frequent cause of serious complications and represents a significant factor in the variation between the results in clinic and private patients.

Evaluation of cure rates was made for 373 private cases in which 103 (28 per cent) survived for five years without evidence of disease. According

to the League of Nations classification 52 were in Stage I with 42 (81 per cent) five year cures, 100 were in Stage II with 35 (35 per cent) five year cures, 129 were in Stage III with 24 (19 per cent) five year cures, and 92 were in Stage IV with 2 (2 per cent) five year cures.

Sites of metastases are detailed for all 822 cases. Only 2 per cent exhibited involvement of bone and less than 1 per cent had supraclavicular lymph node metastasis. The lungs were involved in 1 per cent. The bladder and rectum were common sites for spread of the disease. The regional pelvic lymph nodes were the commonest sites of metastasis.—*Norman Simon, M.D.*

Aune, Edwin F., and White, Benjamin V. Gastrointestinal complications of irradiation for carcinoma of uterine cervix. *J.A.M.A.*, Oct. 27, 1951, *147*, 831–834.

The symptoms caused by structural injury to the intestine are quite variable and may be difficult to recognize. Injuries fall into two groups:

1. *Proctosigmoiditis.* Usually there is tenesmus with diarrhea and blood-stained mucus or frank bleeding. The perirectal tissues may become diffusely fibrous and produce "frozen pelvis" difficult to differentiate from carcinoma.

2. *Ileitis.* Obstructive symptoms are the rule, with distention, cramps, nausea, vomiting and obstipation. Initially the mucosa is red, edematous and friable, and later it becomes atrophic with telangiectasia and scarring. Ulcers may form and perforate into the periteonum, vagina or perirectal tissues.

Symptoms may appear within the first month after treatment or as late as nine years. It may occasionally be difficult to determine whether the symptoms are due to radiation injury or to recurrence of the carcinoma.

The intestinal mucosa is particularly sensitive to irradiation. Overdosage, faulty technique and accidental displacement of radium are common causes of complications. A thin uterus, retroverted uterus, or peritoneal adhesions may cause a concentrated dose on the bowel. Extra precaution is needed when patients have had previous surgery or pelvic infections.

The authors reviewed at the Hartford Hospital 670 patients followed six months or longer and treated by radium needles (4,000–8,000 mg. hr.) and roentgen therapy (6,000–12,000 r) in the majority of cases. They had 3.4 per cent gastrointestinal complications: 26 per cent ileitis and 74 per cent proctosigmoiditis. Three patients died, due to perforation of radiation ulcers, 2 in the rectosigmoid and 1 in the ileum. They also had 7 cases of cystitis, 3 cases of fracture of the femur and 1 case of rectovaginal fistula. The symptoms of colitis in their cases occurred within the first year while the obstructive symptoms varied in their time of occurrence, some not being noted for several years.—*Martha E. Mottram, M.D.*

Cherry, C. P. Radiation effects on the normal endocervix and on adenocarcinomas of the cervix. *J. Obst. & Gynaec. Brit. Emp.*, Oct., 1951, *58*, 774–779.

The author carried out his work at the Strangeways Research Laboratory, Cambridge, England. The study is purely a histopathological one based upon the examination of serial sections of normal cervices undergoing irradiation and serial sections of cervices in which adenocarcinomas had been found. It is pointed out that histopathological changes in the normal endocervix are induced sooner in premenopausal than in postmenopausal cervices. In the normal cervix the changes induced by irradiation consist of hypersecretion, swelling of cells, shedding of secretion and the cells lining the glands, followed by ultimate regeneration.

In adenocarcinomas following irradiation, the histopathological changes are parallel and very similar to those induced in normal tissues. The changes consist of degeneration of tumor foci, simplification of the glandular structure, hypersecretion, eosinophilic condensation of the cytoplasm and a gradual return toward normal histological appearance. The changes encountered here are distinctly different from those seen following the irradiation of squamous cell carcinoma of the cervix.—*C. L. Hinkel, M.D.*

Brown, Willis E., Meschan, I., Kerekes, Ernest, and Sadler, J. M. Effect of radiation on metastatic pelvic lymph node involvement in carcinoma of the cervix. *Am. J. Obst. & Gynec.*, Oct., 1951, *62*, 871–889.

The authors attempt to assess the value of irradiation in the treatment of metastatic pelvic lymph nodes in case of carcinoma of the cervix.

The patients were treated with external roentgen therapy and with radium or cobalt. Surgery was then performed and the cervix and pelvic lymph nodes subjected to microscopic survey.

In specifying the dosage the authors state: A minimum of 10,000 and a maximum of 20,000 r to the cervix and local lesion is necessary; a minimum of 5,000 r to the lateral pelvic lymph nodes is necessary; a maximum of 4,000 r to the nearest rectal point, and a maximum of 4,000 r to the bladder is the tolerance dose; any skin portal receives no less than 3,300 r. These tolerance levels are based on fractionated daily treatments administered over a six weeks' period.

Prior to treatment the patient is examined and discussed jointly by the radiologist and gynecologist. Careful measurements are made. Clips are placed upon the cervix and opaque material is injected

into the bladder and rectum. Roentgenograms are made in the anteroposterior and lateral planes for guidance in planning the technique of irradiation.

The external roentgen therapy is carried out with 200 kv., corresponding to a half-value layer of 1.5 mm. Cu. Six to eight fields are employed. Cobalt 60 or radium deployed in an Ernst applicator are the gamma-ray sources. If cobalt is used, only one-third the time for a given amount of radium is used. If the lesion is classified as Stage I, half the total dose of radium and two-thirds the total dose of roentgen rays are given. This is followed by the remainder of the radium and roentgen dosage. In more advanced cases, roentgen therapy is used initially, followed by radium or cobalt application midway through this treatment. The estimated doses are checked with calculated dosages.

Surgery is performed within from two to twelve months. This consists of a Wertheim operation with a pelvic lymph node dissection.

The series thus treated comprises 42 cases with complete information available in 24 instances. There were 6 lesions in Stage I, 14 lesions in Stage II, and 4 lesions in Stage III.

The average tumor dose to the cervix was 16,744 r (varying from 9,000 to 27,000 r); to the lateral pelvic wall, 5,839 r (varying from 3,500 to 7,800 r), and to the bladder and rectum 3,100 r (varying from 2,000 to 6,000 r).

Of the 24 cases there were 15 without evidence of disease at the time of microscopic examination. There were 3 cases with residual carcinoma in the cervix and extensive involvement of the lymph nodes. There were 3 cases with negative cervical tissue but with positive lymph nodes. There was 1 case with a vesicovaginal fistula without evidence of disease, and 1 case with a rectovaginal fistula with disease. One patient died because of pelvic fibrosis without evidence of disease.

The authors believe that surgery added to the intensive irradiation may well be responsible for a higher incidence of complications. They cite an additional group of cases treated in a similar fashion without surgery. This latter group are almost all without complications to date.—*F. W. O'Brien, Jr., M.D.*

BRUNSCHWIG, ALEXANDER. Partial or complete pelvic exenteration for extensive irradiation necrosis of pelvic viscera in the female. *Surg., Gynec. & Obst.*, Oct., 1951, *93*, 431–438.

On the author's service in the Memorial Center for Cancer and Allied Diseases, over 135 partial or complete pelvic exenterations, mostly for advanced cancer, usually primary in the cervix, have been performed. In this series there was a small group in which study of the excised pelvic organs revealed no evidence of residual cancer but only extensive irradiation effects.

Partial pelvic exenteration consists of excision of bladder, vagina, uterus, and anexa, with implantation of ureters into the colon; complete pelvic exenteration consists of removal of all pelvic viscera.

Ten case reports are presented. In the summary, the author notes that pelvic exenteration, originally devised as an attempt to control extensive pelvic cancer, may also of necessity be performed for extensive irradiation damage to pelvic viscera. The results in a limited series of patients who have survived operation have been very satisfactory in that pain is abolished and the patients are permitted to return to their usual general activities. In this group of 10 patients the hospital mortality was 40 per cent. That all patients accepted the procedure after it had been fully explained to them is evidence of the degree of discomfort they were experiencing from the condition for relief of which the operation was proposed. The status of these patients was such that if operation had not been performed they would have died from complications of the extensive pelvic necroses.—*Mary Francis Vastine, M.D.*

COCCHI, UMBERTO. La radiothérapie des arthroses et périarthrites à Zurich (1933–1950). (Radiotherapy of arthroses and periarthritides in Zurich, 1933–1950.) *J. de radiol. et d'électrol. & Arch. d'électric. méd.*, 1951, *32*, 598–601.

Many physicians still share the opinion that in patients affected with spondylosis or arthrosis deformans the pain is in direct proportion to the presence and size of the osteophytes and not infrequently base the treatment on this assumption.

The author has recently studied the relationship of spondylosis deformans cervicalis to rheumatism by examining the roentgenograms of the cervical spine in 1,017 unselected cases and has coordinated the roentgen findings with the clinical symptoms, incidence of age distribution, and occupation of the patient (see abstract in this JOURNAL, Oct., 1951, *66*, 671–672). It was noted that spondylosis deformans cervicalis is a phenomenon of advancing age, due to wear and tear rather than to occupational influence. The condition may develop silently or may be associated with severe pain, the morphologic changes usually appearing in the latter instance four to ten years sooner. It was also demonstrated that meteorologic changes constituted one of the principal factors for the onset of the disease at an earlier age and that thus rheumatic perispondylitis with its climatic dependence had a very definite role in accelerating the physiologic degenerative process. This acceleration, as a rule, manifested itself clinically by pain and limitation of motion. Other less important causes of perispondylitis, such as infectious foci, angina, dental granulomas, etc., had a similar effect. The same situation also applies

to spondylosis deformans of the dorsal and lumbar spine.

If this view is accepted, the aim of the treatment must be to irradiate the perispondylitis rather than to try to effect a change in the spondylosis, the anatomico-roentgenologic modifications of which cannot be influenced.

The present article gives a statistical compilation of 2,417 cases of arthrosis deformans, spondylosis deformans, and scapulohumeral periarthritis treated during the past seventeen years at the University of Zurich on such a basis. The following technique was used: 180 r (in air) per seance, with 0.5 mm. Cu filter, repeated every two or three days until a total dose of 750 to 1,200 r per series was reached. In certain cases the same series was given two or three months later. Only exceptional cases received also a third series of treatment.

Healing or marked improvement was obtained in 60 per cent of 529 patients with spondylosis deformans, 65.5 per cent of 1,121 patients with arthrosis deformans and 80 per cent of 767 patients with scapulohumeral periarthritis.—*T. Leucutia, M.D.*

Schlungbaum, Werner. Über die Ausscheidung von 17-Keto-Steroiden bei therapeutischer Röntgenbestrahlung. (Concerning the excretion of 17-ketosteroids during therapeutic roentgen irradiation.) *Strahlentherapie*, 1951, *85*, 630–632.

Because of suggestions that radiation sickness might be the result of suprarenal hormonal dysfunction and because of Selye's work on the general adaptation syndrome, 7 patients being irradiated for treatment of tumors were studied to establish their rate of excretion of 17-ketosteroids.

The levels of 17-ketosteroids in twenty-four hour urine specimens collected for several days before irradiation, during irradiation, and for as long as eighteen days after irradiation, showed no variation from normal or from each other.

The conclusion is that either these patients were incapable of responding to roentgen irradiation with an alarm reaction, or that the irradiation given did not produce a biologic stress effect.—*H. G. Moehring, M.D.*

RADIOISOTOPES

Hempelmann, Louis H. Acute radiation injuries in man. *Surg., Gynec. & Obst.*, Oct., 1951, *93*, 385–403.

Four case histories illustrate the acute type of radiation damage.

A. *Acute localized radiation injury.* The example of this type of radiation injury occurred during an atomic bomb test at Eniwetok. The hand of the individual was exposed to highly radioactive materials with no protection other than surgeon's rubber gloves. Most of the injury sustained was due to the beta rays as the highly penetrating gamma rays lost only a fraction of their energy in passing through the hand. It was estimated that the hand received approximately 5,000 to 10,000 rep. of beta rays.

The resultant tissue damage was limited primarily to the skin and subcutaneous tissues. The early erythema was replaced by more intense reddening. Swelling of the hand occurred within a matter of hours but epidermolysis was delayed. The tissue breakdown reached its maximum the fourth or fifth week after exposure. Healing was very slow due to the disturbance in blood supply as evidenced by the ischemic necrosis of the exposed dermal tissues. The epithelium which eventually covered the irradiated area was so fragile that it had to be repaired with free tissue grafts.

B. *Acute generalized radiation injury.* The 3 cases of the acute radiation syndrome occurred as a result of two accidental nuclear fission reactions at the Los Alamos Scientific Laboratory. In these accidents, the inadvertent chain reactions occurred in experimental assemblies of fissionable material. These reactions were identical to that which takes place in an atomic explosion. However, both reactions were stopped before a true mechanical explosion occurred or a significant amount of heat was liberated. The radiations consisted of neutrons and gamma rays mixed with large amounts of beta rays and roentgen rays. The neutrons were responsible for the bulk of the damage to body tissues while very soft radiation is believed to have contributed significantly to the hand damage of Case 2.

The illness in Cases 2 and 3 conformed to the general pattern of the acute radiation injuries in the Japanese. However, the unusual exposure conditions and a personal idiosyncrasy in Case 2 were responsible for some of the reactions which deviated from the clinical course of the injured Japanese. The symptomatology during the febrile response of Case 2 was similar to that seen in other types of illnesses. During the terminal stage of this patient's illness the picture resembled that of agranulocytosis in any individual. The prompt and extensive destruction of the hand in this patient was unlike that usually seen in localized radiation injuries. This was in keeping with the magnitude of the radiation dose which amounted to about 100 times the roentgen dose which is ordinarily given in a single course of the treatment of cancer.

In Case 3 the development of the febrile stage on the fifth day after exposure was unusual (this usually develops the third week after exposure). Neither gastrointestinal symptoms nor petechial hemorrhages occurred with the fever. This was also unusual. The fact that this patient regained robust health shows that some persons can withstand exposure to large doses of total body irradiation. The

complete lack of symptoms in Case 4 is further proof of this observation.

The prompt lymphopenia shown in all these cases is characteristic of radiation injury and is one of the few isolated laboratory findings of diagnostic value. Terminal agranulocytosis such as was seen in Case 2 was the usual finding in the fatally injured Japanese. The eosinophilia displayed in Case 4 is an inconstant finding in persons chronically exposed to radiation.—*Mary Frances Vastine, M.D.*

SZILÁGYI, D. EMERICK, MCCLURE, ROY D., CONNELL, THOMAS H., JR., WATSON, JOHN H. L., and PREUSS, LUTHER E. Radioiodine (I^{131}) tracer studies after total thyroidectomy. *Ann. Surg.*, Oct., 1951, *134*, 546–565.

In following the clinical course of 52 patients on whom total thyroidectomy, *i.e.*, complete removal of all visible thyroid tissue, was performed, the authors observed that the degree of depression of the thyroid function was significantly less marked than in cases of primary myxedema. In an attempt to find the cause of this seemingly paradoxical behavior, 22 of the cases were investigated by radioiodine tracer studies. The cases were operated upon from one to sixty months before the study began, the average being 23.5 months. A tracer dose of 50 microcuries of I^{131} was given orally and the uptake was determined by scanning over the thyroid area and other regions which might harbor thyroid tissue; the cumulative urinary excretion of the tracer over a ninety-six hour period was also determined.

In 54.5 per cent of the cases studied, active thyroid tissue was found in the thyroid region. In 4.4 per cent of the cases, the remaining thyroid fragments had sufficient function to maintain the patients in an approximately euthyroid state. As a group, the cases showed a rough correlation between the cumulative excretion curve and the degree of uptake, but all save one of the excretion curves fell in the definitely hypothyroid state. The latter finding raised the question of whether iodine utilization by the small parenchymatous remnants had characteristics different from those observed in the case of intact glands. Suggestive evidence was found that in cases in which the original lesion was hyperactive there was a greater likelihood of the existence of active thyroid remnants. The exact sites of the remnants were not localized but they appeared to be determined by the technical difficulties.

It is concluded that in any given case it is impossible to predict the degree of radicality of total thyroidectomy; that the differences between the hypothyreosis and athyreosis of the totally thyroidectomized patient and the patient with primary myxedema are quantitative rather than qualitative; and that euthyreosis in a patient after total thyroidectomy is due to active thyroid remnants.—*Norman Heilbrun, M.D.*

ALBERT, A., and KEATING, F. RAYMOND, JR. Metabolic studies with I^{131} labeled thyroid compounds: distribution and excretion of radiodiiodotyrosine in human beings. *J. Clin. Endocrinol.*, Sept., 1951, *11*, 996–1011.

Three myxedematous patients effectively controlled with desiccated thyroid were studied with radioactive diiodotyrosine to learn more about its catabolism.

The method of preparation (by exchange) of radioactive diiodotyrosine is given. Each patient received intravenously 300 microcuries of the sterile I^{131} diiodotyrosine (1–2 mg.), after which blood, urine, and stool specimens were collected periodically and analyzed.

The fractionation procedure for blood and urine is described. It was checked for efficiency, and was found to show no appreciable exchange or contamination.

The 3 patients gave similar results in all the studies undertaken. The serum concentration of diiodotyrosine fell rapdily in the first two hours, whereas the inorganic iodide fraction increased in this time. Apparently this rapid disappearance was not due to in vivo exchange phenomenon, as incubating blood or urine with inorganic iodide and radiodiiodotyrosine under physiological temperature and pH conditions produced no evidence of exchange. The radiothyroxine fraction was insignificant in both blood and urine. The feces contained only minute amounts of total radioactivity.

In vivo scanning of the body with a Geiger-Müller tube failed to disclose any unusual locus of radioactivity.

An analysis of the serum curve showed an initial volume distribution comparable to the whole blood volume. Within two hours the volume distribution was equal to about six times the initial volume. After two hours the rate of disappearance of diiodotyrosine was slower.

It is suggested that diiodotyrosine is excreted in the urine, and possibly deiodinated at a constant rate that is dependent on serum concentration. The exact site of deiodination is not known. The average renal clearance of radiodiiodotyrosine was 5.2 cc./minute. The process of deiodination must therefore occur either in an organ of large volume blood flow or diffusely. The liver and muscles are suggested, respectively, as possibilities.—*Z. S. Gierlach, M.D.*

DOBYNS, BROWN M. Radioactive iodine as an adjunct to the surgical management of diseases of the thyroid. *Surg., Gynec. & Obst.*, Oct., 1951, *93*, 415–427.

Much fundamental knowledge of the normal and pathological physiology of the thyroid has been acquired by the use of radioactive iodine in laboratory and clinical investigation. Several practical applications of radioactive iodine are becoming valuable aids in the surgical management of some diseases of the thyroid.

Radioactive iodine is useful in making a diagnosis of thyrotoxicosis. Severe thyrotoxicosis in patients who represent poor risks may be corrected by the administration of radioactive iodine. The functional capacity of thyroid nodules may be determined preoperatively. This may give a clue to the possibility of encountering malignancy or may serve to identify an excessively functioning nodule which may not yet be causing thyrotoxicosis. The preparation of radioautographs from thyroid nodules that have been removed affords an opportunity to correlate their functional capacity with their gross and microscopic appearance. These methods furnish a means for distinguishing between Graves' disease with an incidental nodule and a hyperfunctioning nodule with thyrotoxicosis.

Although radical operative surgery remains the primary method of treatment of carcinoma of the thyroid, radioactive iodine is of value in a few patients. Most success has been achieved in patients with the follicular type of adenocarcinoma. Complete removal of all normal thyroid tissue and the administration of thiouracil compounds may augment the uptake of radioactive iodine in some metastases from carcinoma of the thyroid.—*Mary Frances Vastine, M.D.*

Lamerton, L. F., and Harriss, E. B. Some autoradiographic studies of non-uniform distribution of radioactive phosphorus in tissues. *Brit. M. J.*, Oct. 20, 1951, *1*, 932–936.

A uniform distribution of a radioisotope within a specific tissue is usually assumed. It was noted by the authors that a spotty distribution of intravenously administered P^{32} was obtained on autoradiographs of rat liver and spleen. Similar distribution after intravenous radiophosphorus administration was also noted for human tissues.

Particulate matter, with uptake by the reticuloendothelial system, was suspected, and it was shown that intraperitoneal injections gave a more uniform P^{32} distribution in the liver and spleen. After centrifugation of the radiophosphorus solution, the supernatant fluid gave few concentrations, while the residual gave more concentrations, after intravenous injection, than the original solution. A carefully cleaned syringe and, in fact, one washed with phosphate carrier prior to filling definitely reduced the spotty distribution.

The authors stress that if particulate or colloidal matter was present in the administered radioactive solution, the distribution would vary with the mode of administration and with the amount of activity adsorbed onto the particles.

Dose distribution was mathematically considered and it was shown that, due to the nonunifomity of distribution of the radioactivity, significant variation in tissue dose occurs, being higher, of course, at the areas of concentration. Numerous photographs of autoradiographs illustrate the paper.—*Z. S. Gierlach, M.D.*

Horn, Robert C., Jr., and Ravdin, I. S. Carcinoma of the thyroid gland in youth. *J. Clin. Endocrinol.*, Oct., 1951, *11*, 1166–1178.

The authors report a series of 22 patients under twenty-six years of age with carcinoma of the thyroid gland. Nineteen of the 22 patients were encountered during the six year period, January 1, 1945, to December 31, 1950. During this same period, a total of 62 thyroid lesions (exclusive of toxic diffuse goiter) were removed from patients under twenty-six years of age.

The incidence of carcinoma of 30.6 per cent in goiters (exclusive of toxic diffuse goiter) coming to surgery in patients under twenty-six is in remarkable contrast to the corresponding figure for all age groups in the same hospital—9.2 per cent. It stresses again the emphasis during recent years on the strong possibility of carcinoma when a thyroid mass is found in a child or young adult.

The authors found cervical lymph node metastasis in 77 per cent of the patients under twenty-six, and in more than 50 per cent clinical evidence of metastasis developed before a goiter was apparent. Indeed, cervical lymph node metastases may be present for years before the primary tumor becomes palpable. Therefore, it is imperative that all lateral cervical lymph nodes be removed for pathological examination.

Treatment, in spite of the very high incidence of regional metastases and even in cases presenting extensive pulmonary metastases, is well worth while. Thyroid cancer in young people is often a relatively benign and slowly progressing disease.

The authors recommend thyroidectomy (hemithyroidectomy with removal of the isthmus if the disease is unilateral), neck dissection if there are palpable cervical lymph nodes, and postoperative roentgen therapy. They carry out tracer studies with radioactive iodine whenever thyroid cancer is suspected. They remove inoperable tumors as completely as possible, together with any remaining normal thyroid in order to facilitate possible subsequent use of radioactive iodine.—*George Cooper, Jr., M.D.*

SEED, LINDEN, JAFFÉ, BERTHA, and BAUMEISTER, CARL. The tracer dose of radioactive iodine in the diagnosis of thyroid disease. *J. Clin. Endocrinol.*, Oct., 1951, *11*, 1143–1156.

The diagnostic value of a tracer dose of radioactive iodine in thyroid disease was investigated in relation to (1) the twenty-four hour thyroid pickup; (2) the twenty-four hour urinary excretion; (3) the total plasma I^{131}; (4) the protein-bound plasma I^{131}; and (5) the ratio of PBI^{131} to the total I^{131} in plasma (conversion ratio). A tracer dose of 50 microcuries of I^{131} was given. The technical steps used by the authors are carefully described.

They found the thyroid pickup and/or the urinary output of I^{131} were excellent diagnostic criteria in the toxic diffuse goiter, were less so in recurrent exophthalmic goiter, and were of little value in pure toxic nodular goiter.

The total plasma I^{131} in itself was of no value in diagnosis. The level of protein-bound I^{131} of the plasma is high enough in the hyperthyroidism of toxic diffuse goiter to be diagnostic, but is not as reliable as the conversion ratio.—*F. J. Rigos, M.D.*

RAWSON, RULON W., RALL, J. E., and PEACOCK, WENDELL. Limitations and indications in the treatment of cancer of the thyroid with radioactive iodine. *J. Clin. Endocrinol.*, Oct., 1951, *11*, 1128–1142.

There are 3 major limitations to the treatment of cancer of the thyroid by radioactive iodine. They are (1) the relative to absolute lack of natural avidity for I^{131} of most cancers of the thyroid, and the natural variability in function of those tumors which do concentrate radioiodine; (2) the physician-induced impairment to natural or induced avidity for radioiodine of certain tumors; and (3) the damaging effects of radiation from radioiodine on normal and vital tissues.

(1) The first limitation is the inability of more than half of all cancers of the thyroid to pick up measurable amounts of radioactive iodine. The concentration of radioactive iodine by cancers of the thyroid occurs primarily in those tumors bearing colloid-filled follicles and only rarely in those tumors not containing colloid. None of the functioning tumors concentrates I^{131} as well as the adjacent normal thyroid tissue. It is possible in some patients with pulmonary or skeletal metastases to induce an avidity for radioiodine. This is done by removing the normal thyroid and by the administration of thiouracil in large doses.

Another natural limitation to the treatment of cancer of the thyroid by radioiodine is the inability of these tumors to concentrate radioiodine in a uniform manner as demonstrated in the radioautographs and also clinically.

(2) The second limitation, impaired avidity for the drug, can be due to the administration of iodine or iodine containing drugs or can be due to the administration of noncancerocidal amounts of radiation, isotopic or roentgen therapeutic.

(3) The third serious limitation to the treatment of cancer of the thyroid by radioiodine is the damaging effects of irradiation on normal or vital tissues. Radioactive iodine is transported by the blood or extracellular fluids until it has been picked up by functioning thyroid tissue or excreted by the kidneys. If the functional capacity of the tumor is small, as is usually the case, nonthyroidal tissues will be exposed to a large percentage of the radioiodine as it travels through the body. The tissues most vulnerable are the kidney, liver gonads, and blood-forming organs. No radiation-induced renal or liver damage could be found in several patients studied. A transient amenorrhea was seen in 3 out of 12 menstruating women. Some degree of radiation damage to the formed elements of the blood or blood-forming elements was noted in all patients receiving a therapeutic dose of radioiodine. This varied from a transient fall in the lymphocytes to a lethal pancytopenia.

The rate of hemoglobin synthesis was reduced after the administration of I^{131} in therapeutic amounts.

The following are the indications for the treatment of cancer of the thyroid with radioactive iodine: (1) that the tumor be not removable by a competent surgeon; (2) that the tumor be capable of concentrating enough radioactive iodine to exert a cancerocidal effect; and (3) that the calculated total body irradiation delivered by the proposed therapeutic dose of I^{131} be within the range of safety.

The authors believe that cancer of the thyroid is a surgical disease best treated by adequate removal of the primary lesion and of the adjacent involved tissues.

A maximum avidity for I^{131} can be obtained in many metastatic tumors by administering thiouracil in large doses over fairly long periods to patients whose normal thyroids have been removed.

The authors believe that this method should be used in all patients with distant metastases. Therapeutic doses of I^{131} are not given to these patients until the forty-eight hour urinary excretion of a test dose of I^{131} is 30 per cent or less. From this study, the amount of radioactive iodine that will be retained by the tumor can be determined.

The dose of I^{131} can be kept within the range of safety since the changes in the total lymphocyte count are the most sensitive index following the administration of I^{131}. This can be correlated by calculating the roentgen equivalent physical (rep.) delivered to the blood by daily determinations of the radioactivity per unit of blood and the percentile

fall in the total lymphocyte count. The dose of radioactive iodine should be kept down to an amount which is calculated to deliver less than 500 rep. to the blood.—*F. J. Rigos, M.D.*

McConahey, William M., and Keating, F. Raymond. Radioiodine studies in thyroiditis. *J. Clin. Endocrinol.*, Oct., 1951, *11*, 1116–1122.

Radioiodine tracer studies were performed on 40 patients with thyroiditis. Twenty-one of these patients had acute diffuse thyroiditis, 13 had struma lymphomatosa and 6 had struma fibrosa. Radioiodine in doses of 100 to 300 microcuries was given orally. Counts were taken over the thyroid at twenty-four or forty-eight hours and the urinary excretion of I^{131} was determined.

These studies revealed that the thyroid accumulation of tracer doses of I^{131} was usually impaired in the 21 patients with acute diffuse thyroiditis although the patients were euthyroid or hyperthyroid. Thyroid accumulation of I^{131} was usually normal in the 19 patients with chronic thyroiditis, although 5 of the patients with struma lymphomatosa had myxedema. The collection of I^{131} by the thyroid in these conditions is not a measure of the secretion of thyroid hormone.—*F. J. Rigos, M.D.*

Chou, Shelley N., Aust, J. Bradley, Peyton, William T., and Moore, George E. Radioactive isotopes in localization of intracranial lesions; a survey of various types of isotopes and "tagged compounds" useful in the diagnosis and localization in intracranial lesions with special reference to the use of radioactive iodine-tagged human serum albumin. *Arch. Surg.*, Oct., 1951, *63*, 554–560.

Radioactive isotopes are useful in the localization of intracranial lesions because disease of a part of the central nervous system causes a break-down of the blood-brain barrier in that area. The authors review the substances used for this purpose.

Radioactive phosphorus concentrates in significant amount in cerebral tumors. Since it is a beta emitter with a maximum penetration of 7 mm. of brain tissue, it is of no value for preoperative localization but has been used for localization at the time of operation.

Radioactive potassium has a high selectivity for tumor tissue and has adequate gamma emission for purposes of localization. It is not of practical value, however, because of its short half-life, 14.2 hours; its energetic gamma emission, which increases radiation hazards; and its high concentration in muscle tissue, making it difficult to detect tumors near the base of the skull.

Radioactive iodine in the form of diiodofluorescein is widely used because it is secreted rapidly by the liver, it is not metabolized, and therefore can be given in large amounts without danger of injury to the thyroid. It disappears quickly from the blood stream, allowing the increased radioactivity of the brain tumor to stand out in relief, and it has no side effects.

The authors have recently used radioactive iodinated human serum albumin with definitive results in 6 of 8 cases, the remaining two being still under study. Radioactive iodinated human serum albumen remains in the blood stream a long time and is metabolized by the body with liberation of iodine, approximately 5 per cent of which is taken up by the thyroid gland. This deposition in the thyroid may prevented, however, by the administration of stable iodine as Lugol's solution starting twenty-four hours previous to the test. In localization, counts are taken on two or three successive days and should show increasing uptake on the second and third days. A relatively large dose must be used and experience is still too limited to be certain that there is no danger of excessive thyroid irradiation. This compound is still definitely in the experimental stage. —*L. K. Sycamore, M. D.*

Perlmutter, Martin, Weisenfeld, Shirley, and Mufson, Monroe. Comparison of a single G-M tube method and a multitube method of assaying I^{131} uptake by the human thyroid. *J. Clin. Endocrinol.*, Sept., 1951, *11*, 1012–1020.

Each of 8 patients ingested 100 microcuries of I^{131}. Per cent uptake was determined by the single tube and by the multicounter in vivo counting methods. About 20–30 per cent higher recovery was noted with the single tube method. This was verified by strapping a tube containing I^{131} to a patient's neck. By this method 30 per cent losses were observed with the multitube method. Because of this finding, the four tubes of the multicounter were checked, and were found to be of similar sensitivity.

Using the single tube method it was shown that placing a vial of I^{131} solution behind a patient's neck will reduce the count recorded (shielding) by 65 percent. For a single tube it is also apparent from the inverse square law that at a distance of 30 cm. or greater from the source a 1 cm. variation of the source forward or backward will produce insignificant losses.

A single tube method, if properly used, is preferable to the multitube method.—*Z. S. Gierlach, M.D.*

Becker, Josef, and Scheer, Kurt Ernst. Radiokobalt als plastisches Präparat zur Strahlenbehandlung. (Radiocobalt as a plastic preparation for radiation therapy.) *Strahlentherapie*, 1951, *85*, 581–588.

Cobalt 60 emits gamma radiation of 1.1 and 1.3 mev. and a weak, easily filtered-out beta radiation equivalent to 0.3 mev. Its half-life is 5.3 years. Its decay product is a stable isotope of nickel, without intermediate, gaseous, radioactive products. Cobalt 60 can be worked like iron and is ferromagnetic. It can be produced in a desired form before it is rendered radioactive.

A fine powder of cobalt 60 can be homogeneously mixed into a plastic mass. With the aid of the laboratory of the Chininfabrik Braunschweig, the authors developed a cohesive, but nonadhesive, plastic mass which could be molded at body temperatures and yet retain its shape in the absence of undue pressure. The powdered cobalt 60 is dispersed in this mass and then the whole can be worked on, and with, wet wooden surfaces.

For superficial applications, a 5 mm. layer of the cobalt 60-plastic mass has been encased in cellophane and taped to the area to be treated. Intracavitary applicators have been shaped as required and then encased in sterilized beef gut, tied at each end like a sausage. Several methods of using this cobalt 60-plastic mass are depicted. Dosage and distribution of dosage are cursorily mentioned since a second communication is promised for the discussion of clinical application, indications, technique and dosimetry.—*H. G. Moehring, M.D.*

BERG, HAROLD F. Localization of radioactivity of colloidal gold^{198}; preliminary report. *Arch. Surg.*, Oct., 1951, *63*, 545–553.

Because of the failure of any striking, specific localization of radioactive isotopes with the exception of iodine^{131}, the author attempted to localize radioactivity by local implantation, using gold^{198} injected into dogs. Controls were established by determination of the distribution of the isotope in the various organs after intravenous injection.

Injection into the renal artery without occlusion of the artery and vein gave a distribution almost identical to that with intravenous injection. If, however, the artery and vein were both occluded for one minute after injection, the injected kidney showed 20 to 25 times more activity than the opposite kidney and other organs showed much lower uptake than after intravenous injection. Injection of the splenic artery after splenectomy and with occlusion of the artery and vein for one minute after injection resulted in concentrations in the pancreas several thousand times those following intravenous injection. Injection into the femoral artery, with or without occlusion of the artery and vein, showed no significant change in comparison with the results after intravenous injection. Direct injection into the pleural space gave concentrations several thousand times those found after intravenous injection. Following injection into the peritoneal cavity the peritoneum showed approximately 18 times the concentration obtained by intravenous injection with an extremely high uptake in the omentum.

Since, on intravenous injection, approximately 90 per cent of the isotope is taken up by the liver, an attempt was made to produce a higher concentration in other tissues by occlusion of the portal vein and hepatic artery for five minutes after intravenous injection. No change in distribution was produced by this maneuver.

The isotope was administered intravenously to a seven year old boy with malignant hepatoma and the distribution compared with that of the dog. It was demonstrated that the tumor cells in the liver had very little pick-up.

The author suggests the possible clinical application in the irradiation of almost any organ that has a specific blood supply, in carcinomatosis of the pleural and peritoneal cavities, in tumors of the urinary bladder, and in tumors of the liver or spleen; also, in blood dyscrasias, because of the high uptake of the liver and spleen and the medullary spaces of ribs and vertebrae.—*L. K. Sycamore, M.D.*

CHEMOTHERAPY

BLAHD, WILLIAM H., LEVY, MARVIN S., and BASSETT, SAMUEL H. A case of Hand-Schüller-Christian syndrome treated with cortisone. *Ann. Int. Med.*, Oct., 1951, *35*, 927–937.

The authors present a case of Hand-Schüller-Christian disease in a twenty-nine year old male. He complained of headaches, chest pain and cough of increasing severity of several years' duration. The chest roentgenogram revealed dense interstitial fibrotic changes in both upper and middle lung fields which were interpreted as being consistent with sarcoidosis. This diagnosis could not be confirmed by muscle biopsy. Marked thirst and polyuria were also present. On several occasions during the course of his illness spontaneous pneumothorax of the right lung occurred.

Eventually an osteolytic defect was demonstrated in the left posterior parietal region of the skull. Biopsy revealed an eosinophilic granuloma compatible with the clinical diagnosis of Schüller-Christian disease. A trial course of ACTH was given but the patient was unduly sensitive to this drug so cortisone therapy was instituted. Patient noted a significant subjective improvement soon after the beginning of cortisone administration, with a return of urine volume to normal. There was, however, no change in the appearance of the lesions seen on the chest film and a further spontaneous pneumothorax occurred. Peripheral edema developed and the liver became palpable; consequently cortisone therapy was discontinued.

The patient then noted a gradual return of his symptoms with loss of weight and strength. Thoraco-

tomy was performed with gradual re-expansion of the lung following surgery. Biopsy revealed changes suggestive of Schüller-Christian disease. Radiation therapy was then given to the pulmonary and skull lesions with little improvement in the patient's general condition.—*W. M. Roy, M.D.*

Cosgriff, Stuart W., and Kligerman, Morton M. Use of ACTH and cortisone in the treatment of post-irradiation pulmonary reaction. *Radiology*, Oct., 1951, *57*, 536–540.

A patient with a single asymptomatic metastatic nodule in the right lung was given a tumor dose of 4,500 r with 200 kv. roentgen therapy.

Several days after completing the fifty-two day course of treatments the patient entered the hospital because of exhaustion, nausea and vomiting, and elevated temperature.

Treatment with antibiotics produced no improvement. When death seemed imminent from pulmonary insufficiency and general deterioration, ACTH was started empirically; 25 mg. was given every six hours. Within forty-eight hours the temperature had returned to normal and the dyspnea and cough decreased markedly. After thirty days, ACTH was discontinued and the patient progressively became worse with elevation of temperature and increased sedimentation rate.

She again showed improvement upon resuming ACTH therapy for a six week period. No immediate symptomatic relapse followed its second withdrawal.

Two months after ACTH was discontinued, late radiation changes of atelectasis and fibrosis had appeared in the corresponding lung. There had been no recurrence of acute symptoms.—*E. E. Seedorf, M.D.*

Luttgens, William F., and Bayrd, Edwin D. Treatment of multiple myeloma with urethan; experience with sixty-six cases over a two-and-a-half-year period. *J.A.M.A.*, Oct. 27, 1951, *147*, 824–827.

Sixty-six patients with multiple myeloma at Mayo Clinic were treated with urethan either orally, intravenously or by a combined method. Thirteen were unable to tolerate even small amounts and are excluded from the report. Forty-eight urethan-treated patients with satisfactory marrow smears are compared with a control group. Both groups include some patients treated by ionizing radiation or stilbamidine or both.

Since the variability in duration of illness correlates fairly well with the cell types present on bone marrow aspiration, comparison is made according to the estimated degree of malignancy. For Groups III and IV the figures show prolongation of life in the urethan group with the average duration of illness 3.6 to 9 months in the control group and 12.5 to 21.9 months in the urethan group. For Group II the duration of life was about the same at the time of the report although a majority of the urethan group were still living. Insufficient time has elapsed to judge results in Group I.

About half the patients, particularly those with the milder form of myeloma, were subjectively improved. Objectively, the results were less satisfactory and only 1 patient has showed marked improvement. Thirteen patients showed a 1 to 3 gm. per 100 cc. increase in hemoglobin concentration. Decrease in sedimentation rate was the most frequent manifestation of improvement. Bence-Jones proteins did not disappear with treatment (13 patients).

Twenty-six patients had repeated roentgenograms and only 3 showed questionable osseous improvement. No change in the degree of malignancy in the sternal marrow smears was found. The plasma cells decreased occasionally immediately after intravenous medication.

A leukopenia of 4,000 was seen in about 75 per cent of the patients and 25 per cent showed 2,000 white blood cells or less. No complications were attributable to the leukopenia and in only 5 cases was therapy interrupted.

Anorexia, nausea, vomiting or diarrhea was noted in 66 per cent of the cases. Only a rare patient could take a daily dose of 2 to 3 gm. urethan orally. Urethan was better tolerated intravenously, but the results were no better.

The authors conclude that urethan is "probably as good treatment as is available for multiple myeloma at the present time."—*Martha E. Mottram, M.D.*

Benedek, Tibor. Selective, chemical epilation in the treatment of tinea capitis as contrasted with the diffuse x-ray epilation. *Urol. & Cutan. Rev.*, Sept., 1951, *55*, 539–550.

The authors note a definite lack of any antifungal value in current local applications for the treatment of tinea capitis. Discarding the idea of killing the fungus, they use a selective, chemical epilation which consists of the application of a compound containing copper sulfate, chloral hydrate, glycerin, and sodium lauryl sulfate. According to the authors, this compound penetrates the hair follicles as well as the shaft and root portions of the hair. It is selective for the hairs which are involved by the fungus and it produces a prompt epilation, following which the activity of the fungus is destroyed. Their experience with 96 cases of tinea capitis covers the age groups from one to fifteen years (61 boys and 12 girls). The preparation used is nontoxic and nonirritating. The time required for its effect depends upon the extent of the disease and is usually from two to four weeks.

The advantage of the method over roentgen therapy is that the treatment can be carried out at home, it is prompt in its epilation effect, it is selective and it is safe.—*G. W. Chamberlin, M.D.*

MISCELLANEOUS

WILLIAMS, SAM W. The paralleling technic for intraoral roentgenology. *J. Am. Dent. A.*, Oct., 1951, *43*, 419–434.

Two weeks after Röntgen's announcement of the discovery of the x-ray Otto Walkoff of Braunschweig, Germany, made the first intraoral roentgenogram. Following this, there was rapid progress in dental roentgenography, which is briefly reviewed in this paper.

A discussion of the technical factors of kilovoltage, amperage, film and target film distance as presently used in dental roentgenography by the bisecting angle technique follows. The influence each of these factors has on the end result is noted, and the conclusion is drawn that the least satisfactory and the one most amenable to improvement is the target film distance, which in most places is presently 7 or 8 inches.

Some illustrations and considerations of increase of detail sharpness as well as relative decrease of distortion by various increases of distance are given. The most practical distance from space consideration in the average installation, as well as cost of conversion, is considered to be 14 inches, which is the length of the average sinus cone.

A technique is proposed using this distance (the parallel refers to the increasing parallelism of the incident roentgen rays with increased distance). The equipment for the technique is described and illustrated. The various details of using the technique for complete dental coverage are given with illustrations.

Finally, there is a series of comments dealing with the various factors which seem to make this technique an improvement over the one commonly in present use.—*J. M. Monaghan, M.D.*

MORGAN, RUSSELL H., and STURM, RALPH E. The Johns Hopkins fluoroscopic screen intensifier. *Radiology*, Oct., 1951, *57*, 556–560.

A system for brightening the image on a fluoroscopic screen from 300 to 3,000 times has been developed at the Johns Hopkins Hospital. The instrument combines the principles of photofluorography and television. The fluorescent image is intensified by a folded Schmidt optical system and focused on the surface of an image orthicon similar to those used in some television cameras. The impulses from the orthicon are electronically amplified and the image is reproduced on a television receiver. With further amplification, the image may be projected on a screen by means of a projection kinescope. No dark adaptation is required for either method of viewing. Any degree of contrast may be obtained electronically. For the same roentgen tube factors, *e.g.*, 70 kv. at 5 ma. and the same relative distances of tube, patient, screen, and viewing, the resolution is approximately the same as that for conventional fluoroscopy. The theoretical limit of resolution has not been approached; hence, with technical improvement and simplification, better definition is possible. The described experimental apparatus has received only limited clinical trial.—*M. B. Goodwin, M.D.*

POPPEL, M. H., SORRENTINO, J., and JACOBSON, H. G. Personal diary of radiation dosage; plea for a standardized system. *J.A.M.A.*, Oct. 13, 1951, *147*, 630–632.

This is a plea for every individual to carry a personal diary of radiation exposure, entries to be made by every radiologist making roentgenographic or fluoroscopic examinations. A dosage chart to compute adult dosage for common procedures is given.

The authors feel that any part of the body exposed to 100 r in air should not be re-exposed for three weeks. Doses of between 60 and 100 r in air may be repeated after two weeks' rest. Doses below 30 r in air may be repeated daily up to 100 r per week.—*F. H. Squire M.D.*

MATTSSON, OVE. Causes of drying marks on radiographs and their prevention. *Acta radiol.*, Oct., 1951, *36*, 273–289.

Only correct drying of the wet film with its swollen gelatin will make each particle in the gelatin return to the position it occupied before it was wet. Drying is best performed without special heating at room temperature and with ample circulation or relatively dry air. Unfortunately, heating arrangements have to be used to reduce the drying time.

A high degree of humidity in a heating cabinet will increase the risk of irregular blackening of a film. The humidity increases the drying time and by retarding evaporation keeps the temperature of the film at a higher level.

The most frequent cause of local variations in density on a film is the presence of water drops remaining on the surface of the gelatin during drying. Of course, drops may be splashed on the surface after drying. A certain dissolution of the swollen gelatin accompanied by a corresponding change of the silver image may occur in these drops as a result of protracted drying.

If a drop of water moves during the drying a stripe will be visible on the film.

All these changes are most easily discovered by inspection of the two emulsion layers of the roentgenograms and by studying the light reflexes from the emulsion surfaces.

A final rinse in a solution of a so-called wetting agent contributes greatly to complete draining of the films. Wetting agents reduce the surface tension and produce uniform spreading of the water over the film surface, preventing drops and making it easier

for the water to slip off quickly.—*Mary Frances Vastine, M.D.*

Groskopff, K.-W., Bolck, F., and Büll, H.-J. Thorotrastschädigungen. (Injuries due to thorotrast.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, July, 1951, *75*, 34–49.

After a brief discussion of the physical and chemical characteristics of thorotrast, the authors relate in detail the case history of a forty-one year old male who came under their observation in 1950 with rather vague complaints of nausea and occasional vomiting. While serving in the armed forces he froze both feet during the winter of 1941–1942, resulting in intermittent claudication. In order to return him to active duty a sympathectomy was performed late in 1943. Eight days before the operation an arteriogram of the left thigh was done using thorotrast as contrast medium.

Thorough clinical examination at present did not reveal any definite pathological changes; the liver was enlarged and tender to pressure. All blood chemical tests showed values at the upper level of normal; the albumin-globulin ratio was 2.16. No significant changes were observed in the blood count. Roentgenologically, considerable amounts of thorotrast could be demonstrated in the liver, spleen, some retroperitoneal lymph nodes, the walls of a few blood vessels in the right lower pelvis, and also in the right upper thigh. They attributed the latter finding to a probable attempt at doing an arteriogram also on that leg for purposes of comparison. Geiger counter readings could not be obtained over the spleen, liver or upper thigh.

A piece of liver tissue was removed for histological study. By exposing a special photographic emulsion to a small amount of ashed liver tissue, the authors were able to demonstrate alpha tracks on the film identical to those produced by thorotrast.

Microscopic examination showed fibrosis in spleen and liver as well as proliferation of endothelial and reticulohistiocytic cells leading to a hypertrophy of Glisson's capsule, thus causing liver atrophy and eventually complete destruction of the parenchyma.

The authors believe that following the original injection the thorotrast moves via the lymphatics into the periportal connective tissue; there may also be some hematogenous spread with deposits in the reticulo-endothelial cells of the liver. Athough it was impossible to detect either clinically or morphologically signs of serious liver damage, the prognosis is nevertheless serious because of the continued presence of the radioactive thorotrast and the irreversibility of the deposits. A survey of the recent literature also indicates that malignant neoplasms, especially sarcoma, may develop years after the injection of thorotrast.—*E. A. Pohle, M.D.*

Ariel, Irving M. The effect of single massive doses of roentgen radiation upon the liver; an experimental study. *Radiology*, Oct., 1951, *57*, 561–575.

This is an experimental study of the acute morphologic alterations which occur in the rabbit's liver following single massive doses of roentgen irradiation to that organ. Ninety-six animals were studied after having received single doses ranging from 300 r to 100,000 r. Response to irradiation varied greatly in different animals of the same species receiving equal doses. In general, the changes involved all of the component parts of the liver.

Following the 300 r dose there was slight transitory edema throughout the liver and slight congestion of the smaller vessels. Animals receiving the 3,000 r dose showed transitory, acute inflammatory cellular infiltration in the portal areas and to a lesser extent throughout the sinusoids. Edema was found to be most marked in the central part of the lobule, and polymorphonuclear leukocytic infiltration was most evident in the portal areas. These changes were thought to be due to damage to the vascular system. Small necrotic areas were occasionally noted three days following 3,000 r. Healing by regeneration of liver cells was indicated by the absence of necrosis seven days later.

Some animals showed marked histopathologic alterations at various intervals following 30,000 r, others presented an apparently normal liver with variable amounts of edema and congestion.

In general, the liver cells were damaged or destroyed in proportion to the dosage, with very high dosage causing complete necrosis. When repair was possible it was found to occur rapidly. Necrosis was confined to the area of liver in the direct beam of radiation, except in the largest doses, where there was some evidence of necrosis outside of the direct beam. —*A. W. Sommer, M.D.*

Morse, Anna, and Greep, Roy O. Effect of abnormal metabolic states upon the histochemical distribution of alkaline phosphatase in the tibia of the albino rat. *Anat. Rec.*, Oct., 1951, *111*, 193–219.

In studying this interesting problem, the authors reached the following conclusions:

Abnormal metabolic states, produced by dietary imbalances and hypophysectomy, cause changes in the morphology of the tibia. While these changes have no effect upon the details of the localization of alkaline phosphatase, the overall distribution of the enzyme is greatly influenced. Thus, it is found that in rickets the total reaction is increased from the histochemical standpoint because of the increase in the quantity of the phosphatase-positive elements such as the hypertrophic epiphyseal cartilage and the osteoid tissue. At the other extreme are the tibias

from the hypophysectomized animals which show a reduction in reaction due to a decrease in number of phosphatase-positive cells in the cartilage and metaphysis. Intermediate reactions occur during aging, mineral imbalance and caloric restriction.—*T. J. Wachowski, M.D.*

HEGEMANN, GERD, and LEUTSCHAFT, RODERICH. Röntgenspektrographische Untersuchungen über Kollagenstrukturen bei der Wundheilung. (Roentgen spectrographic investigations on collagen structures in wound healing.) *Klin. Wchnschr.*, Oct. 15, 1951, *29*, 665–668.

In 1950 Hegemann and his collaborators found that collagen fibers in fresh scar tissue do not show the characteristic birefringence observed in older scars nor have they as yet acquired a resistance toward digestion by trypsin. The present report is a continuation of these investigations; roentgen diffraction was used to study the submicroscopic structures of collagen fibers produced in wound healing tissues.

The observations were made on regenerating tissue after a cut in the Achilles tendon of rabbits. The roentgen diffraction method employed was that suggested by Johannsson, using a curved monochromator, a powder camera with peripheral carrier of the object and a cylindrically curved film.

Interpretation of the diffraction patterns obtained permits the following conclusions: No properly arranged grid of collagen molecules is formed during the first three weeks of wound healing. Orientation of the polypeptide chains along the direction of the fibers and their union to micelles cannot be expected before the sixth week of healing. After two months the roentgen diffraction pattern is again similar to that of normal tendon tissue, although a certain lack of orientation in the molecular arrangement may still be noticed. After four to five months the pattern becomes entirely normal.

This excellent paper illustrates well the great value of a purely physical method in the investigation of a complicated biological problem, such as the submicroscopic arrangement of collagen fibers offers.—*Otto Glasser, Ph.D.*

GELBKE, HEINZ. The influence of pressure and tension on growing bone in experiments with animals. *J. Bone & Joint Surg.*, Oct., 1951, *33-A*, 947–954.

The purpose of the experiments reported in this paper was to solve certain problems connected with the influence of mechanical factors on the growth of bones. In 1862, Hueter and Volkmann advanced the theory that compression inhibits the growth of bones, and produces atrophy, while tension increases bone growth and the formation of osseous tissue. This theory was disputed by Wolff who claimed that both compression and tension lead to the formation of osseous tissue and to increase in bone growth.

No agreement has yet been reached, according to Gelbke, on the opposing theories of Hueter and Volkmann, on the one hand, and Wolff, on the other. His conclusions are as follows:

1. A permanent and maximum degree of pressure inhibits longitudinal bone growth and does not lead to a compensatory increase in girth. This inhibition of growth is due to the prevention of proliferation in the growth cartilage, which narrows and becomes irregular in its arrangement. New bone formation, that is, replacement of the available cartilaginous tissue, proceeds without any interruption. Atrophy of the bones does not occur.

2. Strong and permanent tension does not increase endochondral bone growth; on the contrary, it has nearly the same effect as compression when it is applied directly to the bone. The nature of the insertion of the ligament at the apophysis seems to be such that there is no danger of extreme unphysiological tension.

3. Changes caused by mechanical forces appear to be reversible to a certain extent, if these forces are removed before skeletal maturation.—*R. S. Bromer, M.D.*

LELAND R. COWAN

President of the American Radium Society, 1950-1951